THE COYOTE PREDATION ISSUE: A SURVEY OF POLICY AND PERSPECTIVES WITH A FOCUS ON SOUTHERN IDAHO

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PREFACE

This paper is a compilation of an amorphous mass of information on the coyote predation issue in the U.S.A. with a focus on southern Idaho. It covers the period from the origins of the federal animal damage control program in the late 1800's up to 1981. Its aim is to survey the key factors involved in this issue relative to a backdrop of different and changing perspectives and the federal policy responses to these differences and changes.

The data and information were gathered through reviewing the literature and through discussions with individuals and groups having extremely diverse views on the coyote predation issue. Two weeks were spent in southern Idaho gathering data and discussing the issue with Animal Damage Control (ADC) agents, trappers, Environmentalists, and coyote researchers. Many days were spent on the range learning about sheep ranching and the Woolgrowers predation problems.

The paper is organized in five sections. The first section describes the evolution of the coyote predation issue and federal policy responses. The second section outlines the problem from three diverse perspectives, that of: the Woolgrower, the Animal Damage Control agent and the Environmentalist, and that of an American who simply prefers coyotes to sheep. It presents some of the myriad of different factors that are of concern to them. The third section sketches the biology of the coyote or the key variables in coyote population dynamics. The fourth section presents two of the few disturbance experiments available for coyote populations at the time of this study. The fifth and final section presents the data from 1928 - 1981 on the number of coyotes killed and the percentage of sheep losses for Idaho.

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SUMMARY

Policy Development

Coyote predation on sheep in the U.S. is a problem that originated with sheep ranching at the end of the 19th century. Since this time, sheep ranchers (Woolgrowers) have paid for the right to graze their sheep on public lands. As a consequence, they felt that the payment of grazing fees placed the responsibility for predator control with the government.

In 1886, the Bureau of Biological Survey of the United States federal government was formed and began investigating the Woolgrowers' predator problems. By 1914, experiments and demonstrations in predator control were conducted by the Bureau. The Woolgrowers did not find this effort sufficient for controlling their predation problems and in 1915, they went to Congress to request direct Federal involvement in controlling predators.

This request was reinforced by increased demand for food and fiber due due to World War I, as well as by the need to control a surprise rabies epidemic. Politics, problems and perceptions came together and predator control soon became a major priority. The Bureau accepted responsibility for directly controlling predators as distinct from simply studying the problem.

For many years the federal government used a variety of methods to suppress coyote populations on public lands used by Woolgrowers. After World War II, the use of toxicants became important and Compound 1080 (sodium monofluoroacetate) was seen as somewhat of a panacea because of its potency, ease of use and inexpensiveness.

By the 1960s, the public became more interested in public lands, which many considered to be 'wilderness' areas. In concert with this intensified public interest, environmental protection groups became actively involved in this issue. Very soon "public clamor" arose regarding the coyote control policies of the federal program. This surprise from the social system resulted in the Secretary of the Interior requesting his Advisory Board on Wildlife Management to "investigate the role and practices of the federal Government in animal damage control and to recommend changes, if needed, to ensure an environmentally sound and socially acceptable federal Animal Damage Control Program." Based on this report a number of policy adjustments were made.

In 1971, the Federal Government was again surprised when environmental groups filed an injunction against the Department of the Interior. A subsequent study revealed that while policy adjustments had been made which were in line with the recommendations of the 1964 report, few changes had been implemented after the 1964 study and that significant change would require legislation. In 1972, President Nixon banned the use of toxicants in the federal program. It was suggested that effective alternatives existed. Many of the other recommendations of the study were not implemented. The toxicant ban appeased the Environmentalists but not most Woolgrowers and Animal Damage Control (ADC) managers who viewed this as an unwarranted action and felt that toxicants were necessary for coyote control. Tension was enhanced by the fact that the Woolgrowers were not allowed a

preliminary review of either the 1964 or the 1971 report, although they had initially been promised one. For a number of years suits and counter suits ensued with the United States Department of the Interior (USDI) and the Environmental Protection Agency (EPA) on the one side and the Woolgrowers associations and state governments on the other. The state governments were also opposed to the toxicant ban. As a result, the 1972 Executive Order banning toxicant use was modified in 1975. In 1977, special permission was given for the experimental use of compound 1080 in the toxic collar.

The President of the United States included, in his 1977 environmental message, a special clause concerned with predator control policy. He stated that since predators play an important role in various ecosystems, the goal of a control program must not be to destroy them but to minimize their conflict with livestock. He reported that his administration would continue to support the toxicant ban and that if control was necessary it should focus on the predators causing the problem and not the species as a whole. Pursuant to this message, the Associate Director of the United States Fish and Wildlife Service (USFWS) circulated a message throughout the department emphasizing that the objective of the predator control program was the selective control of depradating individuals or local populations and sanctioned the use of preventive methods only in areas of historic losses to predators. The president of the Woolgrowers Association wrote to the Secretary of the Interior expressing the Woolgrowers discontent with the existing program and recommended a number of changes.

In 1977, the Secretary of the Interior responded to the concerns over predator control by requesting a policy study of the problem. The Office of Audit and Investigation concluded that the "Fish and Wildlife Service (FWS) cannot effectively determine whether the estimated expenditures of $8 million US dollars in fiscal year 1978 had a significant impact on the prevention of livestock losses by predators in areas where ADC methods were utilized." Public opinion surveys included in the report elucidated conflicting values between the livestock owners and segments of the general public. Forty-four percent of those interviewed were aware of the coyote-sheep issue and approximately the same percentage believed it to be important. Major public concerns were specificity and humaneness in control methods.

In 1979, a new policy statement was issued by the Secretary of the Interior. It was followed by a policy document the next year. The document stated that the program goal was "to assist in reducing wildlife caused damages in a manner which takes into consideration impacts on the environment" and that social acceptability is important.

Responses to the 1980 ADC Policy were as polarized as the concerns that initiated the study on which it is based. The degree of emphasis on local corrective control was considered unrealistic by most Woolgrowers and ADC managers. Once again the Woolgrowers expressed their discontent at not being directly included in the design of this policy which affected them. Consequently, as in 1915, the Woolgrowers once again approached Congress to request assistance in coyote control.

A Variety of Perspectives

The woolgrowing industry, in Southwestern Idaho, consists of farm flock and range operations for the production of food and fiber. Essentially, it is the range operators who have the majority of obstacles to overcome in their attempts to maximize production. Along with land use restrictions and labor shortages, coyote predation is the major problem they perceive. While at certain times and in certain places coyote predation is a serious problem, most ranchers feel that preda-

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tor control is not their job but that of the government, from whom they lease the lands and to whom they pay 50% of the predator control costs.

The Animal Damage Control (ADC) Program is sponsored by both the livestock interests and the federal government's United States Fish and Wildlife Service (USFWS). Through the use of preventative and corrective strategies, it attempts to minimize sheep losses. The implementation of these strategies are constrained by government policies and field difficulties so that the local ADC manager feels frustrated in his ability to minimize losses for his 'client', the sheep rancher.

Many trappers, Environmentalists and naturalists are opposed to the use of public lands for sheep ranching and/or to the ACD program and its practices. The reasons range from deeming coyotes as the "truest of all Americans" to dislike for sheep as invaders of wilderness areas to concern for the specificity and humaneness of ADC methods. Economic concerns are also expressed by trappers and those who question the return for tax dollars spent on the ADC program.

The 'Natural' System

Between 1972 and 1980 coyote densities for the USA fluctuated within approximately a 35% margin and those for Idaho within approximately a 50% margin. The Idaho population reached an eight year low point in 1980. Locally, regular cyclic fluctuations in numbers are evident. Densities appear to be determined by prey availability and coyote behavior. Coyote food habits vary relative to the abundance and availability of jackrabbits and rodents. There is evidence to indicate that both coyote densities and feeding behavior play key roles in the population dynamics of other animals. It has also long been recognized that coyotes play an important role in the reduction of rodent populations.

The Disturbance Experiments

Current research indicates that "substantial" levels of coyote population reduction do not reduce annual coyote densities. Control efforts tend to supplant natural population reduction mechanisms. In an experiment comparing recruitment rates for differentially controlled areas, a larger percentage of the females bred and raised litters in the areas with higher levels of population control.

Another experiment involved two comparable populations - one with "substantial" annual coyote removal and another with no organized control effort. The results showed no significant differences in spring or fall coyote densities or annual survival rates for the two populations although kill rates were substantially higher in the managed populations. However, there were indicators of differences in population composition. The factors contributing to the return to similar population levels were: decreased natural mortality, increased recruitment, and decreased emigration in the managed system. Residents of the managed population also had a lower average body weight - a potential indicator of less healthy animals. This may be the effect of reduced selective pressures (whereby less fit animals are expelled from the population) while the density is temporarily lowered in managed population. managed population.

Idaho Data: Coyotes Controlled and Sheep Lost

A relationship between the number of coyotes killed and the number of sheep lost to coyotes has not been established. The heterogeneity involved in these variables makes this an extremely difficult task.

The number of coyotes killed over time is influenced by: funding levels, control methods and their efficacy, trapping trends, federal policy, as well as coyote, sheep, and rabbit population levels, and distribution. In turn, the number of sheep killed by coyotes is influenced by: ranching practices and coyote, sheep, and rabbit population levels as well as the number of coyotes killed.

According to ADC agents, it is the short term reduction of coyotes that is crutial, particularly during the lambing period.

> "Substantial levels of coyote population reduction does, definitely, reduce coyote densities for short periods of time. Both "preventative" and "corrective" control strategies are based on this proven fact. It is also a proven fact that killing coyotes (sometimes one and sometimes more) does stop killing of livestock (Packham, pers. comm.)."

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1. POLICY DEVELOPMENT

1.1. 1800s: Early History

One of the many hardships faced by settlers moving to western North America in the 1800s was coyote predation on their livestock (USDI, 1945). *Canis latrans*, "the barking dog," had inhabited the western plains since the Pleistocene (Young and Jackson, 1951). This animal was naturally perceived as a rather lowly beast by the settlers and often, along with the other predators, represented the unpredictable forces that eminated from the wilderness in which they struggled to make a home. An early and colorful description of the coyote was given by Mark Twain, who visited Nevada in 1861.

> About half an hour after breakfast we saw the first prairie-dog villages, the first antelope, and the first wolf. If I remember rightly, this latter was the regular coyote (pronounced ky-o-te) of the farther deserts. And if it was, he was not a pretty creature, or respectable either, for I got well-acquainted with his race afterward, and can speak with confidence. The coyote is a long, slim, sick and sorry-looking skeleton, with a gray wolf-skin stretched over it, a tolerably bushy tail that forever sags down with a despairing expression of forsakeness and misery, a furtive and evil eye, and a long, sharp face, with a slightly lifted lip and slightly exposed teeth. He is a general slinking expression all over. The coyote is a living, breathing allegory of Want. He is always hungry. He always poor, out of luck and friendless. The meanest creatures despise him, and even the fleas would desert him for a velocipide. He is so spiritless and cowardly that even while his exposed teeth are pretending a threat, the rest of his face is apologizing for it. And he is so homely! - so scrawny, and ribby, and coarse-haired, and pitiful. When he sees you he lifts his lip and lets a flash or his teeth out, and then runs a little bit out of the course he was pursuing, depresses his head a bit, and strikes a long, soft-footed trot through the sage-brush, glancing over his shoulder at you, from time to time, till he is about out of easy pistol range, and then he stops and takes a deliberate survey of you; he will trot fifty yards -another fifty and stop again; and finally the gray of his gliding body

> blends with the gray of the sage-brush, and he disappears. All this is when you make no demonstration against him; but if you do, he develops a livlier interest in his journey, and instantly electrifies his heels and puts such a deal of real estate between himself and your weapon, that by the time you have raised the hammer you see that you need a minnie rifle, and by the time you have got him in line you need a rifled cannon, and by the time you have "drawn a bead" on him you see well enough that nothing but an unusually long-winded streak of lightening could reach him where is now (Twain, 1953).

Potential predator problems for Woolgrowers were noted by early explorers. In 1790, David Thompson, a pioneer geographer said: "they (the western plains) are well adapted for raising cattle, and when the wolves are destroyed, also for sheep" (Green 1945). (Throughout early history coyotes and wolves were often both referred to as wolves.) This sentiment was echoed in 1860 by Francis Hayden, director of the Geological Survey: "Sheep especially would thrive well if properly cared for, as far as grazing is concerned, though the great numbers of wolves with which the country abounds would present a formidable concern" (Green, 1945).

However, these warnings did not prepare the settlers for the realities of predation. In early efforts to deal with predation, community gatherings were called. In fact the first meeting of the settlers in Willamette Valley, Oregon, in 1843, was called the "wolf meeting" and was primarily to formulate measures of protection against predators (Green, 1945).

A number of predator control techniques were utilized by the early settlers. Community hunts were organized, either as a preventative measure to reduce local predator populations, or as a corrective effort to eliminate a particularly destructive coyote or wolf. (The hunts soon became popular as a sport.) Poisons were also utilized. Strychnine was placed in carcasses found on the range. This practice was encouraged and became an unwritten "law of the West" (USDI, 1945). Defensive control measures were also employed by the livestock owners. A number of these were: night corrals, fences and dogs. Many of these defensive efforts were successful, particularly for smaller flocks (Lantz, 1905).

Another method of coyote control, initiated in the West in approximately 1 850, was the bounty program. Any party who was interested in coyote control (usually government agencies) paid for coyote scalps. However, this system soon became corrupt as scalps other than coyote's were turned in for payment. The bounty plan rose to its peak prior to 1915, after which time it was replaced by a coordinated federal government control plan.

Fur trappers played an essential, yet irregular, role in early coyote control. Trapping intensity varied with the price of furs, as set by fashion trends and the availability of preferred furs such as beaver. From 1860-1885 coyote and wolf pelts were particularly valuable and this resulted in an intensive poisoning campaign. Some hundreds of thousands of coyotes, along with wolves and other small mammals, were taken from an area extending from Canada, through the mid-western states, to Texas. Wolves were all but eliminated from this area (Young and Jackson, 1951).

1.2. Late 1800s: The Initiation of a Control Program under the Bureau of Biological Survey

In the late 1800s, an increasing degree of dissatisfaction with existing predator control was expressed. At this time the average loss rate for sheep in the western states was reported to be 5%, but losses as high as 20% were reported. The coyote was cited as causing a decline in the sheep industry at this time (Lantz, 1905).

The Bureau of Biological Survey, a branch of the Department of Agriculture, was founded in 1886 to investigate both predator and rodent problems. The Bureau was rapidly inundated with complaints from all over the country. The Forest Service was a major source of complaints as it administered the public lands on which livestock grazed. The ranchers complained to the Forest Service, who in turn complained to the Bureau. Demands were made for a better system of controlling predators. The bounty plan was considered far from adequate. In response to these demands the Bureau began investigating predator damage to livestock and wild game and published four reports: "Key to Animals on which Wolf and Coyote Bounties are often Paid" (1909), "Destruction of Deer by the Northern Timber Wolf" (1907), "Directions for the Destruction of Wolves and Coyotes" (1907) and "Coyotes in their Economic Relations" (1905). The Bureau of Biological Survey originated as an investigative body, but as a result of the complaints from the Forest Service and livestock owners, evolved to an advisory capacity by the early 1900s.

The Bureau's investigations revealed the coyote to have both detrimental and beneficial habits. The sheep industry's coyote predation problem was recognized.

> The coyote is especially notorious as an enemy of the sheep industry. In many parts of the west sheep raising has greatly languished because of the depredations of wild animals upon the flocks. While some of the inju-

> ry is caused by larger wolves, mountain lions, bears, and lynxes, the coyotes are by far the most formidable enemy. They are not only more abundant than the other animals mentioned, but they are present throughout the year, and their depredations are a steady drain upon the resources of the flock owner, comparable in extent to the losses caused by worthless dogs in many parts of the country (Lantz, 1905).

Consequently, the Bureau gave advice on control methods. However, it was also recognized that the coyote performed a valuable service for farmers by reducing rabbits and rodents. This was also useful to the Bureau as its mandate included control of these animals. The coyote's importance in maintaining the balance of nature and its value as a carrion-eater were also pointed out.

> Besides rabbits and prairie dogs, the food of the coyote is known to include the following mammals: rice rats, kangaroo rats, woodrats, ground squirrels, woodchucks, voles, pocket gophers, chipmunks, and pocket mice. All of these are more or less harmful, and the coyote performs an important service in preying upon them. The service is not an occasional or sporadic one, but lasts throughout the year and throughout the life of the coyote. When the number of animals taking part in the work is considered, the enormous importance of its bearing in maintaining the 'balance of nature' becomes apparent. The coyote is useful also as a scavenger. ... On the ranges they soon consume dead horses and cattle, leaving the bones clean (Lantz, 1905).

Keeping in mind the beneficial, as well as the detrimental role of coyotes, Lantz (1905) suggested that if

> ... domestic animals (were) entirely protected, the coyotes would return to their original beneficial occupation as scavengers and destroyers of noxious rodents.

He advised "Everywhere to keep small flocks of sheep."

By the turn of the century, the livestock interests were extremely dissatisfied with the predator control situation. The ranchers believed that since the federal government charged fees for grazing public lands, the federal government should be responsible for controlling predator damage to livestock on these areas.

> The stock interests felt and forcibly expressed the sentiment that it was unfair to collect a grazing fee from any owner whose stock grazed a forest heavily infested with wolves and other predators (USDI, 1945).

The Forest Service also increased pressure on the Bureau to do something about the predator problem. The federal government responded by appropriating funds to the Bureau. The funds were for "experiments and demonstrations" on improved control techniques. This response was attributed to the large interest the government had in the vast acreages of undeveloped public lands (USDI, 1945).

Neither stockmen nor the Forest Service were satisfied with "experiments and demonstrations" and in 1915 irate stockmen went to their representatives in Congress to obtain aid from the federal government for active predator control.

1.3. 1915: A Surprise from the 'Natural' System and the Creation of a Predator Control Program

In 1915, an unexpected event occurred in the 'natural' system. A rabies epidemic broke out in the West. It raged through southeastern Oregon, northern California, southern Idaho and northern Nevada. In this same year, an act was passed that "called for direct participation by the Biological Survey in control work instead of mere instruction" (USDI, 1945). The government responded to the epidemic with an immediate appropriation of funds. This rapid response by the government dealt with the rabies epidemic and also appeased the ranchers. The rabies epidemic "acted as a decided stimulus to the trend which for more than a decade had been gradually centering the control work on wild animals in the Biological Survey" (USDI, 1945). The Federal Government's decision to become involved in predator control work was undoubtedly influenced by a sequence of factors: constant pressure from the Woolgrowers and Forest Service, increased needs for food and fiber due to World War I and the pressure to control the rabies epidemic.

The Bureau, in its new animal damage control capacity, found the suppression of the rabies epidemic to be a difficult task. In 1916, additional funds were appropriated and "the Secretary of Agriculture was given broad discretionary powers as to procedure" (USDI, 1945). The West was divided into eight districts. Each district had an inspector and all of the districts were coordinated by a supervisor. Full-time hunters and trappers, who had been employed from 1915, "... gradually reduced the outbreak from plague-like proportions to sporadic and localized outbreaks by early 1919" (Young and Jackson, 1951).

Note: Sporadic outbreaks of rabies have been recorded throughout history, but it is not known if epidemics are cyclic in occurrence. "Literature on coyote rabies is extremely rare" (Bear, pers. comm.) Gier et al. (1978) note that an outbreak of similar magnitude has not occurred in the USA since 1915. Gier has noted epidemics are more likely to occur when overpopulation, food shortage or hunting pressure promote concentrations of animals. The U.S. Public Health Service has noted that the most common vectors transmitting rabies to man, pets, or livestock, are skunks, bats, racoons and foxes. A 1971 study, under the chairmanship of Dr.

Peter Kennedy, did not support killing wildlife as an effective deterrent to rabies. Gier et al. (1978) have suggested:

> Control of rabies in domestic dogs is probably the greatest safeguard against rabies in coyotes that we can provide, although an epizootic in coyotes could be started from fox, skunk, or bat, either from a bite by the rabid animal or by a coyote eating another animal dead from rabies.

1.4. 1919: The Continuation of the Predator Control Program

By the time it was perceived that the rabies epidemic was suppressed, four years had passed and a task force of field men and supervisors had been established. The Bureau had become responsible for "controlling wolves, coyotes and other animals injurious to agriculture and animal husbandry on the national forests and the public domain" (USDI, 1945).

The men of the Bureau soon became the heroes of their day. They belonged to a "fighting organization" that pushed back the 'unfriendly' wilderness and in doing so allowed the ranchers to "populate the range country with flocks and herds, and in this way ... lower the cost of production of livestock and of the meat that goes upon the family table" (Bell, 1920). As the wilderness was "pushed back" and ranching spread, the ranchers came to rely on the Bureau, and a good working relationship developed (Bell, 1920).

The earliest methods of predator control used by the Bureau were shooting, trapping, snaring, denning and poisoning. Denning is the practice of finding coyote dens in the spring and killing pups and adults. Often even if the adult isn't killed, predation will stop, presumably due to the mother's decreased food requirements. Strychnine had been introduced in 1847 and was heavily used in tallow drop baits. According to Bell (1920), thousands of coyotes were killed and a corresponding decrease in livestock losses was noted.

1.5. 1925: A Change in Name from The Bureau of Biological Survey to The Division of Predator Animal and Rodent Control

The Division of Predatory Animal and Rodent Control was formed in 1925. As the Bureau had not conducted surveys for 25 years, this new name more accurately reflected its function. The Bureau had been involved in rodent as well as coyote control. Rodents were considered to cause excessive damage to forests and crops

(USDI, 1945).

1.6. 1931: The ADC ACT

In 1931, the guidelines for the new Division were laid out by Congressional mandate. The Act focussed on the "eradication, suppression, or bringing under control ... coyotes ... and other animals injurious to ... animal husbandry ... and for the protection of stock and other domestic animals through the suppression of rabies" (Appendix I). It is interesting to note that the predator control program was sparked into existence with the outbreak of the rabies epidemic and that the suppression of rabies is a key element in the 1931 Act. Although the act was passed by a majority of the House, even at this time a flicker of opposition existed. A representative from Missouri was the dissenter:

> At a glance it is doubtful what fitting title should be given to the Bill, but it certainly can be classified as a destructive measure. Its purpose is to destroy - destroy everything in the way of wild animals from a mountain lion to a field mouse ... Fur bearing animals, not destructive in any way, are being killed by the thousands due to the fact that they eat the poison that is scattered around for the ground squirrels, prairie dogs, jack rabbits, pocket gophers, porcupines, woodchucks, field mice, and so forth.

Although the goal of the Federal Control Program was not formalized until the passing of the 1931 Act, it had remained unchanged since the early years of the Bureau of Biological Survey. This goal was to control (eradicate or suppress) coyotes in order to protect livestock and enhance the productivity of the western ranges. The methods employed to accomplish this task had not changed from those utilized in suppressing the rabies outbreak. The response to the rabies epidemic had been to reduce the coyote population as much as available funds and manpower would allow. When this epidemic was over, the same technique of population reduction was used to curtail livestock losses.

During the 1920s and 1930s opposition to the predator control program increased. Some people complained that the interests of the public at large were not taken into account, although the issue clearly included the use of public lands and resources. The stockmens' influence in Congress was suggested as a reason for this.

> As I look at the matter, the fight is between the stockmen, who have enormous influence in Congress, and the rest of us who have no influence at all (Merriam, 1932).

However, during the difficult economic times of the 1930s the predator control program provided jobs for many of the unemployed.

1.7. 1939: Responsibility for the Division of Predatory Animal and Rodent Control Shifts from The US Department of Agriculture to the US Department of the Interior

In 1939, responsibility for predator and rodent control was moved from the Department of Agriculture to the Department of the Interior. The Division's first formalized policy statement, issued in 1940, suggested that the management of coyotes would be one of control and not eradication and that conservation interests must be considered. Policy statements in the 1950s and 1960s contained similar clauses.

> ... the management of injurious species of wild animals has been and will continue to be one of control rather than of complete eradication. The Service is not embarked on a general extermination program; but, with every proper consideration for conservation interests, it has as its objective in this field the adequate control of injurious mammals, so as to reduce to the minimum the economic losses for which they are responsible.

Early Research Efforts: When the predator control program was transferred to the USDI, the Division of Wildlife became responsible for predator research. This research was a one- or two-man effort which extended over 20 years (USFWS, 1977). During this period, research focussed on testing new control methods. The use and efficiency of bait stations and strychnine drop-baits was studied and their effectiveness compared with that of the trap. The effects of control methods on other wild species were also evaluated (USFWS, 1977).

Poison-impregnated bait stations were used in the federal control program in the early 1940s. Tallium sulfate was the original toxicant used, but by the late 1940s it was replaced by Compound 1080 (sodium monofluoroacetate), a substance which was less expensive, more accessible and easily deployed as it was water soluble. Compound 1080 was injected into the carcass of a freshly killed sheep or horse. The carcasses were left, throughout the winter, in an area likely to be frequented by coyotes. From 1949 to 1972, approximately 1500 stations were set out each year. They extended over approximately 15% of Idaho (USFWS records, Boise).

In the late 1949s, 'coyote-getters' were introduced. A coyote-getter is a small set gun which shoots a cyanide loaded shell into the mouth of the predator when it tugs on the bait. Because of the tool's lack of refinement and "the success of poison bait stations, chances were reduced for quick acceptance of the control device" (USFWS, 1977). Once initiated into the predator control program, the coyote-getter was used in Idaho until the early 1970s, when it was replaced by the M-44, a spring-activated version. This tool has the advantage of being relatively selective when it is properly placed and used with the appropriate scent.

Planes were used for the sport hunting of coyotes as early as 1935. By 1948, planes were incorporated into the Idaho Federal Control Program. Aerial gunning was utilized as a method of coyote control along with bait stations, coyote-getters, ground shooting, trapping, snaring and drop baits.

1.8. 1960s: A Surprise from the Social System - Changing Social Objectives

A small faction of the American public had been opposed to the federal government's predator control policy since the early years of the program. The number of dissenters increased, as time passed and by the end of 15 years of a toxicant-oriented program, the federal government was surprised by a large number of people who were opposed to its coyote control policies.

By the 1960s many social objectives had changed. More Americans became aware of and concerned with the environment in general and the management of public lands and wildlife in particular. Sharp (1981) suggests that an increased standard in living and a resultant increase in time for quality of life factors played an important role in this shift in priorities. Essentially, more time was available for recreational pursuits and aesthetic interests. Also concerns began to be expressed for environmental quality and limits to growth. Concern was expressed regarding possible impacts of management practices on the ecosystems. [In Idaho public lands constitute 60% of the state (USFW records, Boise).]

Some citizens opposed the killing of coyotes while others were concerned that control methods be humane. Some Americans had never seen a coyote, but wanted to know that the animals were safe, not only from extinction, but also from suffering. Members of the public, as well as some individuals involved in predator con-

trol, expressed concern over the effects of coyote control on non-target species.

1.9. 1965: The Federal Response - A Policy Study Results in a New Policy Document and a Change in Name from The Branch of Predator and Rodent Control to The Division of Wildlife Services

In 1964, in response to "public clamor" (Cain, et. al., 1972), Secretary of the Interior Udall, requested his Advisory Board on Wildlife Management "investigate the role and practices of the federal government in animal damage control and to recommend changes, if needed, to ensure an environmentally sound and socially acceptable Federal Animal Damage Control Program."

The Leopold Report concluded that the control program needed to be modified to rid it of certain excessive control practices, however, a federal program of predator control was considered necessary to address the needs of the sheep industry. The report stressed the importance of native animals to the American people. It suggested that government policy should be one of husbandry to all animals and that animal damage control should focus on the depredating individual. The study also found Compound 1080 to be a relatively humane and effective method of damage control.

The recommendations of the Leopold Report were as follows:

1. A longer term Advisory Board on predator and rodent control be appointed with members from all major community and public interest groups;
2. The Branch of Predator and Rodent Control change its name and reassess its function and purpose in light of the changing public attitude and knowledge about wildlife;
3. A new explicit set of criteria to guide control decisions be formed;
4. A greatly expanded wildlife research program be developed; and
5. The use of 1080 or any other poison capable of having severe secondary effects on non-target wildlife species be closely regulated.

In 1967, the federal government released a formal predator control policy statement based on the Leopold report (Appendix II). This policy statement gave the men at the operations level the guidelines for their work. Basically, these guidelines were:

- Animal damage control will be conducted to achieve definite plan *goals*: protection of human health and safety, protection of urban areas, protection of forest and range, protection of crops and livestock.
- Animal damage control, as performed by the Bureau, is *defined* as the management of damaging bird and mammal populations at levels consistent with the needs and activities of man and includes environmental manipulation, reduction, the use of repellents and cultural methods.
- The Bureau's animal damage control program will be *designed* in a manner which will ensure the maintenance of the varied native wildlife and wildlife habitats of the United States.
- In conducting this program, the Bureau must also be *mindful* of its responsibilities for protecting wildlife resources.
- It is *an objective* of the Bureau to reduce animal depredation as selectively as possible, and to direct control at the depredating individual or local depredating population.

For the control agent in the field, the job was still to protect sheep by controlling coyotes.

In response to the Leopold Report, some of the changes that were made to "ensure a socially acceptable Federal Animal Damage Control Program" were: the name of the control program was changed from "The Branch of Predator and Rodent Control" to "The Division of Wildlife Services" and the Division was given "increased responsibility in wildlife enhancement"; the field agents were encouraged to become involved in public activities and the enhancement of introduced species was suggested because "wildlife transplants always have a great deal of public appeal" and changes in basic control terminology were introduced.

1.10. 1971: Another Surprise from the Social System and a New Policy Study

In March of 1971, the federal government met with yet another surprise. Civil actions "requesting an injunction prohibiting the use of toxic chemicals for wildlife damage control and certain other relief," had been filed against the USDI by the Council for the Defenders of Wildlife, Sierra Club and the Humane Society of the United States. These repercussions were unexpected. Modifications in the Predator Control Program were considered to have been made as a result of the Leopold

Report. However, segments of the public felt that the modifications made, were insignificant.

The Department of the Interior, along with the Council on Environmental Quality, responded to this surprise by appointing a committee directed to "study the entire predation damage situation in the United States." The Committee approached the problem by analyzing the response to the Leopold Report. The results of the study were published as the Cain Report of 1971. The Cain Report concluded that, although progress had been made in updating predator control activities, the recommendations of the Leopold Report had not been implemented. It stated that "the basic machinery of the Federal cooperative-supervised program contains a high degree of built-in resistance to change" and suggested that this was because the ranchers financed approximately half of the program and because the field personnel had not changed.

The Cain Report advocated substantial changes in the predator control program and stressed that policy must take full account of the entire spectrum of public interests and values. It suggested that legislated changes were needed in the areas of financing, personnel and control methods.

The basic recommendations of the Cain Report were:

1. The Division of Wildlife staff should be professionalized by emphasizing employment of qualified biologists;
2. A cooperative trapper training program should be established in all states;
3. Congress should provide some means of alleviating the economic burden on livestock producers who experience heavy losses to predators;
4. Program funding should be exclusively by congressional and state legislative appropriation; and
5. All existing toxic chemicals should be removed from registration and use for federal operational predator control, with similar restrictions at the state level.

1.11. 1972: A Policy Reversal - Compound 1080 and Other Toxicants are Removed from Use in The Federal Predator Control Program

In 1972, President Nixon placed a ban on Compound 1080 and other toxic chemicals used in Federal control programs or on Federal lands. It was suggested that effective alternatives existed. The ban was brought about by Executive Order 11643 and was followed by the Environmental Protection Agencies' cancellation of registration of these toxicants. Another recommendation that was implemented was the employee educational upgrading program. Trapper training programs were not established. Kansas and Missouri had established their extension programs many years earlier and these had shown positive results (Gier, 1968). Livestock owners continued to finance approximately 50% of the predator control program. A compensatory program to offset heavy losses to the Woolgrowers was not established.

The livestock owners severely criticized the policy changes that resulted from the Cain Report. They claimed that the decision to ban toxicants was based on questionable assumptions as well as vague and conflicting evidence. They noted that the results of the Cain Report were in conflict with those of the Leopold Report, which had started that Compound 1080 was a safe and selective tool. Furthermore, the Woolgrowers were disturbd as they had been promised a preliminary review of both reports, but this had never occurred.

On the other hand, segments of the public, who had opposed earlier policies, were appeased by the removal of toxicants from the federal control program. The interests of the Environmentalists were reflected in the National Environmental Act of 1969 and the 1973 Endangered Species Act, as well as Executive Order 11643 banning toxicants. These acts emphasized the responsibility of the Secretary for all wildlife species and their environment. The Woolgrowers and ADC agents felt their interests were being ignored.

1.12. 1974: A Change in Name from The Division of Wildlife Services to The Animal Damage Control Program

The Animal Damage Control Program was formed in 1974. ADC agents claim that this change in name was to emphasize that the program's purpose was to control animal damage.

In 1974, as a result of the toxicant ban, a number of suits and countersuits began to be exchanged between two opposing factions. One faction consisted of the USDI and the Environmental Protection Agency (EPA). The other faction consisted

of the Woolgrowers Associations and the State Governments who were opposed to the removal of toxicants from the federal predator control program. A conflict also arose with the Wyoming Department of Agriculture who continued training applicants to use Compound 1080 in meat baits for predator control on state and private lands.

By 1975, Executive Order 1163, which had banned federal toxicant use, was modified. Sodium cyanide was made available for experimental use and in the following year was registered for use in the M-44. The application was limited to government agents and certified individuals. The M-44 once again became an operational tool, however, it was subject to many restrictions. The Environmental Protection Agency refused to register the toxicants for general use because of insufficient data to demonstrate that their benefits were greater than the risks incurred by their use. In 1977, special permission was given for the experimental use of Compound 1080 in the toxic collar.

Research in the 1970s: As a result of the ban on toxicants and pressure from both livestock and environmental groups, increased funding was made available for predator research in the 1970s (Table 1). Funds were allocated for improving control methods, assessing sheep damage and studying predator ecology and behavior. The proportion of funds allotted to these various projects is shown in Table 2. Little, if any, funds were made available either to study the nature of the problems involved in the predator control issue, or to assess the long-term objectives of the Animal Damage Control Program.

A census technique was established to determine the effect that the toxicant removal would have on overall coyote numbers. This technique, which is still used today, utilizes 400 scent station lines in 17 states. Each line has 50 stations placed every 0.3 miles on alternating sides of an unimproved road. The scent station is a three-foot circle of sifted earth with an odor attractant placed in the center. Animal visits, based on tracks, are recorded daily for each station for a period of five consecutive days each September.

After the toxicant ban, livestock interests and environmental groups pressured the government to find alternative methods of coyote control. Research in the 1960s had attempted to limit coyote populations by the use of reproductive inhibitors. Coyote control research throughout the 1970s also focussed on nonlethal devices. Studies were conducted on adversive agents and predator repellents and limited research was done on guard dogs. Some experiments were done on lethal control methods. Research was conducted on the toxic collar; a poison-

Table 1. Fish and Wildlife Service total ACD research funds, and funds for predator research of FWS, USDA, and EPA, fiscal year 1970-1978.

Fiscal Year	Total ADC Research[3]		Predator Research	
	Actual	Constant 1967 $	FWS	USDA
1970	1,559.0	1340.5	98.2 (6)*	—
1971	1,758.1	1449.4	121.0 (7)	—
1972	1,735.0	1384.7	130.0 (7)	89.0
1973	2,746.0	2063.1	350.8 (16)	190.0
1974	1,680.0	1137.4	823.7 (18)	641.0
1975	2,715.2	1684.2	848.2 (20)	652.0
1976	2,866.7	1681.3	1,135.0[1] (20)	638.0
1976A**	2		231.1 (20)	159.5
1977	3,380.6[2]	1871.5	839.0 (21)	447.0
1978	3,480.0	1797.5	842.4 (21)	726.0

Permanent full-time employees in parentheses.

**Transition quarter, July 1, - Sept. 30, 1976.

[1] Includes $300,000 from EPA for toxic collar research

[2] Transition Quarter included in FY 1977 total.

[3] Overhead costs not excluded.

Table 2. Funds for Fish and Wildlife Service predator research by type of research, fiscal year 1970-1978.

Fiscal Year	Methods	Predator Ecology and Behavior	Damage Assessment	Total $ Actual	Total $ Constant 1967
1970	32.0	66.2	-	98.2	84.4
1971	54.0	67.0	-	121.0	99.7
1972	54.3	67.2	8.5	130.0	103.7
1973	105.2	210.5	35.1	350.8	263.3
1974	253.0	310.7	260.0	823.7	557.7
1975	269.0	305.2	274.0	848.2	526.2
1976	554.5**	320.5	260.0	1135.0**	665.7
1976A*	70.5	87.8	72.8	231.1	135.5
1977	374.0	360.0	105.0	839.0	464.6
1978	378.0	345.0	119.4	842.4	435.1

* Transition quarter, July 1 - Sept.30, 1976

** Includes $300,000 from E.P.A. for toxic collar research

filled collar which is placed around the neck of a sacrificial lamb. This lamb is positioned in a situation where it will be vulnerable to predation. Behavioral studies of coyotes have shown that they generally kill a sheep by biting its neck.

1.13. 1977: A Presidential Statement on Predator Control

The President of the United States included, in his 1977 environmental message, a special clause concerned with predator control policy. He stated that since predators plan an important role in various ecosystems, the goal of a control program must not be to destroy them but to minimize their conflict with livestock. He reported that his administration would continue to support the toxicant ban and that if control was necessary it should focus on the predators causing the problem and not the species as a whole.

> ... the public's interest in wildlife specifically includes predators, which have in the past sometimes been regarded as competitors for livestock or game, leading to their destruction (and in the case of some large predator species, to their extermination). Because we now realize the importance of the role that predators play in various ecosystems, our goal should not be to destroy them but to reduce the occasion for their conflict with livestock. My Administration will continue to support the existing Executive Order which prohibits the routine use of poisons for killing predators on public lands. If control is necessary, it should focus on the individual predators causing the problem - not the species as a whole...

Pursuant to the President's message, a statement was circulated through the USFWS by the Associate Director. It emphasized that the objective of the predator control program was the selective control of depredating individuals or local populations and sanctioned the use of preventative methods only in areas of historic losses to predators (Appendix III).

The President of the Woolgrowers Association wrote a letter to the Secretary of the Interior. The livestock owners were dissatisfied with the existing program and wanted a number of changes (Rich, 1979). Some of the changes they wanted were:

- A 75% increased utilization over five years of existing control techniques;
- Increased research efforts to develop a suitable toxicant;
- Increased preventative control in areas of historic high losses;

- Accelerated mechanical control use;
- Emergency use of 1080 under strict federal supervision;
- Adequate funding and personnel to make the program effective in the field; and
- A five-year joint USDI-livestock industry assessment of the program's effectiveness.

1.14. 1977: The Federal Government Responds with a Policy Study

In 1977, the Secretary of the Interior responded to the concerns over predator control with a policy study on the problem. This study generated:

- An investigation of the federal control program operations by the Office of Audit and Investigation;
- A lengthy report entitled "Predator Damage in the West: A Study of Coyote Management Alternatives";
- Four public hearings located in Idaho, Wyoming, Texas, and Washington; and
- An environmental impact statement.

The Office of Audit and Investigation concluded that the "Fish and Wildlife Service (FWS) cannot effectively determine whether the estimated expenditures of $8 million dollars in fiscal year 1978 had a significant impact on the prevention of livestock losses by predators in areas where ADC methods were utilized." An inadequate data base was identified as a major problem area. Information was incomplete in such areas as the number of livestock protected and the total number of livestock lost to predation. The report, "Predator Damage in the West," summarized existing information on predator control and surveyed alternate methods of predator management.

Three public opinion studies were included in the 1977 report, "Predator Damage in the West." These studies elucidated conflicting values between the livestock owners and segments of the general public. Major public concerns were specificity and humaneness in control methods. Kellert's (1976) interviews with 553 randomly selected individuals in the United States are summarized in Table 3.

Table 3. Summary of public opinion study on coyote control.

QUESTION	IN FAVOR	OPPOSED
There is nothing wrong with using steel traps to catch fur-bearing animals.	- raised in areas of population 2,000 - black males - farmers - livestock-raisers - hunters - trappers - residents of the west central U.S.	- raised in cities population 1,000,000 or over - pet owners - white females - bird watchers - backpackers - students - anti-hunters - residents of the Pacific Coast and middle Atlantic States
Predatory animals like coyotes or foxes should not be protected when they kill farm animals.	- raised and living in small towns - married - pro-hunters - farmers - blacks - livestock-raisers - trappers - those with less than 8th grade education	- residents of large urban centers - ages 18-29 - white females - students with college educations - single persons - pet owners - bird watchers - backpackers - anti-hunters
I favor protecting some kinds of wildlife even if it hurts the economic livelihood of farmers.	- single persons - urban residents - ages 18-29 - students - birdwatchers - backpackers - anti-hunters - college educated - professionals - from middle Atlantic, east central, and Pacific Coast States	- married persons (partic. with children) - farmers - livestock-raisers - trappers - those over age 65 - rural residents - hunters - those with less than 8th grade education - from west central, south central and Rocky Mountain States

Arthur (1978), interviewed 2041 people throughout the USA to determine public attitudes toward predator control on western sheep ranges. Forty-four percent of the people interviewed were aware of the coyote - sheep issue and approximately the same percentage believed the issue to be important. Only these people, who were both aware of the issue and believed it to be important, were asked specific coyote questions.

Respondents generally believed that coyotes kill sheep. Arthur's study displayed that interviewees generally preferred nonpredators or domestic animals to predators. The majority of respondents did not side strongly with either sheep or coyotes.

The Arthur study indicated that there was approximately an equal concern for coyotes killing sheep as there was for men killing coyotes. Approximately two-thirds of the people felt a farmer should have the right to eliminate an animal killing his livestock, however, over half of these people felt that the farmer should not kill animals in an attempt to prevent future losses. Most respondents accepted severe controls in cases of extremely high lamb losses. If lamb losses were less than extreme, moderate control, safe to other animals, was preferred. More concern was expressed for the inadvertent killing of domestic or other wild animals than non-target coyotes.

In the Arthur study, the respondents' criterion for evaluating control methods, in order of importance, were: humaneness, specificity and cost. Fast poisons and ground shooting were considered to be more acceptable control methods than aerial gunning, denning, trapping, or slow acting poisons. The study indicated that controlling coyotes was preferred to giving economic aid to sheep ranchers.

In 1975, Buys conducted a survey of rancher's attitudes. This study "noted a tendency of respondents to regard damage to livestock in general as greater than that occurring to their own operation." Ninety-two percent of the Woolgrowers were of the opinion that a large amount of predator control was necessary for the survival of the industry. Generally, ranchers in this study saw predators (coyotes, bears, cougar, bobcats) as having little appreciable value in the ecosystem.

1.15. 1979: A New Policy Statement

In 1979, a new policy statement was issued by the Secretary of the Interior. It was followed by a policy document the next year. The document stated that the program goal was "to assist in reducing wildlife-caused damages in a manner which takes into consideration impacts on the environment." The importance of social acceptability was also stressed.

> The mission of the Fish and Wildlife Service is to "provide the Federal leadership to conserve, protect and enhance fish and wildlife and their habitats for the continuing benefit of people". The Animal Damage Control Program plays an essential role in the attainment of this mission. Specifically, the Service's goal for this program is to: assist in reducing wildlife caused damages in a manner which takes into consideration impacts on the environment.
>
> Accomplishment of the Service's ADC goal requires that three broad Program goals be achieved. The goals of the program are to:
>
> 1. Assure that Animal Damage Control Program activities cause no ecologically significant adverse impacts on national or regional wildlife populations.
> 2. Assure that Animal Damage Control Program activities are as socially acceptable as possible.
> 3. Assist in reducing wildlife-caused damage to man's interests.

Consideration for the environment has been included in previous policy statements, but this was the first time it was directly expressed as a part of the program goal. General policy guidelines for the program (Appendix IV) included:

- The use of preventive controls only in areas of high loss;
- A phasing out of lethal methods;
- Emphasis on corrective control and selective non-lethal methods;
- The use of extension services;
- The elimination of denning;
- Tight controls on aerial hunting, particularly in winter; and
- The humane and selective use of traps, etc.

Responses to the 1980 ADC policy were generally as polarized as the concerns that initiated the study on which it is based. However, in some areas, Woolgrowers, ADC personnel, Environmentalists and policy makers expressed a common opinion. A summary of these responses is given in Table 4.

Table 4. Summary of responses to 1980 ADC policy (Andrus Policy).

WOOLGROWERS	ADC OPERATIONS AND RESEARCH PERSONNEL	PRIVATE TRAPPERS AND ENVIRONMENTALISTS	POLICY MAKERS
The decision was a political one and not based on the sound judgement of our experts in the field.	There's just no room for politics in a sound wildlife management program. Our report was ignored and the policy decision was strictly a political move lacking in factual considerations and objectivity.	The livestock people have a strong political hold in Idaho.	If they'd put as much effort into the ADC at the operations level as they do into politics, this policy would work.
"They"are all Democrats.....			"They" are all Republicans.
We could use more controls and less paper pushing.	We'd be a lot better off without all the bureaucrats.		Due to all the bureaucracy the policy making process lacks responsiveness.
		The world is constantly changing but it takes a brave man to recognize this and change policy accordingly.	
The trouble is that everyone lives in the city now and what do city slickers know about ranching. They think their food comes from Safeway.	Most professional biologists and the public are taught attitudes on ADC that are a retreat from the realities of life.	They're so utilitarian. a thing only has value if it means cash in the pocket.	
	Policy should be made from the ground level up by those doing the job and not by some little old lady in tennis shoes who lives in New York.		Policy should reflect the needs of the American people. Strictly ground level input is shortsighted and tunnel visioned.

WOOLGROWERS	ADC OPERATIONS AND RESEARCH PERSONNEL	PRIVATE TRAPPERS AND ENVIRONMENTALISTS	POLICY MAKERS
This policy protects the coyote at the expense of the sheep. I think the value system is back-wards.		Coyotes have aesthetic resource and recreational value. It's about time this was given consideration.	
Corrective controls are useless. What's the good of calling the doctor when the patient is dead?	Corrective controls used alone, are not an effective means of reducing losses.	This preventative control business is like draining the ocean in order to catch fish.	
We need more public education on the problem.....			
Are you one of us or one of them?			
The rancher is the original environmentalist.	We love wildlife every bit as much as the environmentalists.	It's about time somebody considered the wildlife.	

The most intense reaction to the new policy came from the Woolgrowers. They felt that all of their effective tools had been or were about to be lost. They viewed this policy as a digression and were not about to accept it. The ranchers once again approached Congress for help, as they had done in 1915. They proposed a revamping of the entire ADC program. The USDI was charged with not fulfilling its obligation to control predators, as mandated by the Animal Damage Control Act of 1931. The Woolgrowers requested that the program be returned to the Department of Agriculture. They also appealed for the reinstatement of Compound 1080, along with other toxicants and a return to preventive controls.

2. A VARIETY OF PERSPECTIVES ON SHEEP RANCHING AND COYOTE CONTROL

2.1. The Sheep Industry in Southwestern Idaho*

Southwestern Idaho has been a sheep producing area for many years. The industry reached its peak in the 1930's and has been on a downward trend since then (Figure 1). In many areas today, decayed loading ramps stand next to defunct railway tracks. Decades ago these areas bustled with activity as lambs were loaded into boxcars and shipped to market. In many places the railway was built expressly for the purpose of taking lambs to market. However, for the relatively few Woolgrowers that remain, it is no longer profitable to maintain them.

There are two basic approaches to raising sheep in Idaho; farm flock and range operations. Generally, farm flock operators have less than 200 ewes which are grazed in fenced pastures adjoining other farms. Range operators, however, generally have over 1000 sheep which graze on vast open (unfenced) rangelands. In Idaho, the majority of grazing land used by the range operator is federal or state land.

There are nearly 1400 farm flocks and approximately 200 range operations in Idaho (Boyd, pers. comm.). The range operations own approximately 52% of the sheep in the state. Some of the largest ranches have 10–15,000 ewes in addition to their lambs, grazing the open range. These ewes travel over many miles of rangeland in a year of grazing.

For half a century the ewes belonging to a particular family have trekked the same 400-mile route. Often, the old belled ewe in the lead, knows the way better than the new Peruvian herders. To watch the first band of a thousand sheep move across the bridge and down the main street of town makes you feel you have stepped back in time, that is until you are shocked into the present by the blasting horns of annoyed auto drivers. It takes a long time for a thousand sheep to cross a bridge, and who has patience for that nowadays? The old dogs know where the trail leads out of the city, so when the thirsty herder stops for a beer, they and their sheep continue on their way.

*Information in this section was acquired through conversations with individuals from four range and three farm flock operations in Southwestern Idaho.

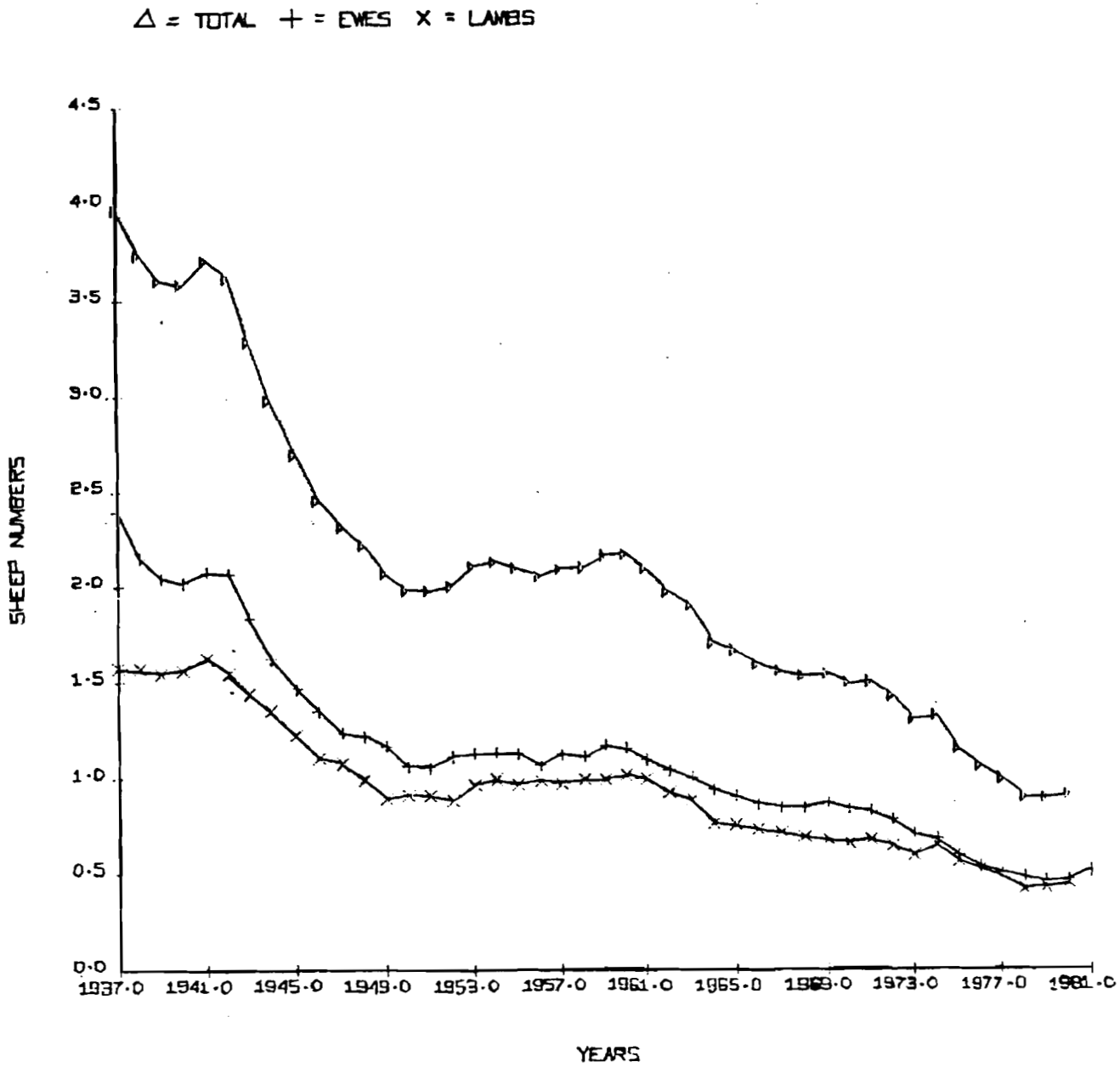

Figure 1. Sheep numbers, in millions of sheep, in Idaho.

The Woolgrowers in Southwestern Idaho are businessmen; they are in the business of producing food and fiber. Their goals are similar to those of their forefathers; to protect and expand their flocks and obtain the greatest return on their investment. One rancher expressed it this way: "I'm paid by the pound for my labor and I've only got 150 days to put the pounds on my lambs."

2.1.1. Woolgrowers' problems

Sheep ranchers in Southwestern Idaho have a myriad of problems to overcome in order to meet their goals. Some of these problems include: restrictions on public land use and predator control, increased interest rates, estate taxes, government regulations, competition from foreign markets, increased costs of fuel and equipment, labor shortages, weather, disease, predation and market fluctuations (Figure 2).

2.1.1.1. *Market fluctuations*

The price that Woolgrowers receive for their lambs depends on the amount of lambs available at the time. One rancher claims: "Getting lambs to market at the appropriate time is much like playing blackjack in Nevada." In the fall of 1981, an Idaho rancher lost $100,000 because the price per pound 'crashed' days before his stock reached his buyer.

2.1.1.2. *Labor*

Many Idaho sheep ranchers have often considered labor difficulties to be their worst problem. Local labor is almost nonexistent. Historically, ranches have remained in the family. Nowadays, however, "the kids are into other things" and not interest in the long days of hard physical labor. Originally, young herders came West from Tennessee and Virginia, but as the country became industrialized, they turned to more profitable jobs in the cities.

The availability of foreign labor is dependent on economic trends in the laborer's homeland, as well as immigration policies in the United States. Since the mid-1800's Basque herders had worked the western ranges. These men were excellent at their jobs, but by the 1970's, prospects in Spain had improved and the immigration of Basque herders to America substantially decreased. Since 1957, ranch-

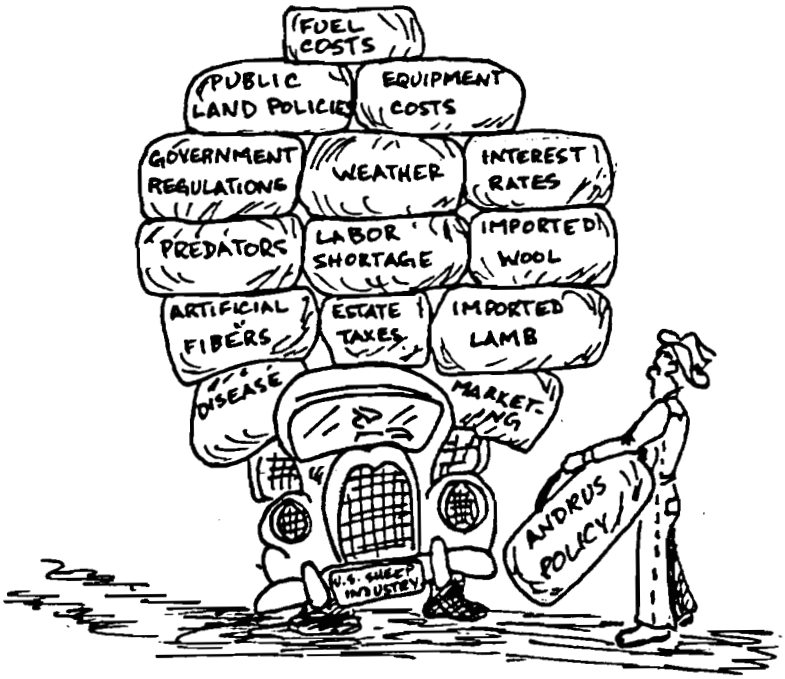

Figure 2. Woolgrowers' problems.

ers have had an arrangement with the federal government to import Peruvian (and some Mexican) herders. However, a lack of coordination between the Department of Labor and the Immigration and Naturalization Service creates endless immigration complications.

Herders are paid their plane fare, two weeks vacation, compensation, and approximately $600 per month. For many, their employment is a means of immigrating to America and herding sheep is not particularly important to them. After three years, they may be eligible for permanent-resident status. Once they become residents, they generally move on to higher paying jobs.

The life of a herder is a rugged one. Herding is a year-round operation and the winters may be severe. If the rancher can afford it, two herders may work and live together in a 'covered wagon,' which is usually moved by a team of horses. If the terrain is not conducive to wagon travel, or if the rancher cannot afford wagons, the herders live in tents. Periodically, one man lives and works alone.

Skilled herdsmen must be able to guide the animals to the best forage and bedding grounds. The animals must be kept in loose aggregations and moved slowly. If the sheep are run in tight bunches, the range is destroyed and the animals stressed. Herders must know how to care for sheep, dogs or horses that are sick or injured. They must also know how to deal with 'pile-ups.' Pile-ups occur when the sheep are frightened by a wild animal (often a bear or a cougar). The sheep at the rear of the flock panic, running over those in the lead. As many as 500 sheep have been known to die of suffocation in a pile-up. While all these deaths are due to the presence of a predator, usually only a few of these are the direct result of predation.

Mistrust between the immigrant herders and the ranch owners is common because the herders do not speak English and their stay in America is subject to endless 'red tape.' Unpleasant situations have developed when herders had to be sent back to Peru and didn't understand what they had done 'wrong.'

2.1.1.3. *Land Use Restrictions*

Strict government land management regulations are another of the major problems that range operators must deal with. Most of the grazing lands used by the ranchers are administered by the Forest Service, the Bureau of Land Management (BLM), or the State. A grazing fee of $0.46 per month is charged for each ewe grazed on federal lands. The fee for state lands varies from $0.30 to $1.20,

depending on the assessed forage quality. A large operator with 10,000 ewes will pay approximately $5,000 per month.

Available grazing lands are subject to changing land use priorities. By law, the state lands must be used for the purpose which gives the best economic return. Reforestation on both Forest Service and B.L.M. lands surged in the early 1970's, along with the rising price and demand for lumber. From 1960 to 1975, the Forest Service grazing areas decreased by 25% (Boyd, pers. comm.). As one rancher explained, in 1974 the Forest Service discouraged grazing, but by 1981 (when 2,4-D was no longer allowed for understory control), the land managers were again encouraging grazing.

As well as dealing with changing land management priorities, the ranchers have to work within spatial and temporal land use restrictions. They have certain B.L.M., State, and Forest Service allotments for specified days of each year. These rules often have more to do with calendars and bookkeeping than actual range conditions. The rancher also conducts his own range management practice. He may choose to forego using an allotment if he feels it is not in good enough condition. A deteriorated range will do him no good the following year. On the range his sheep must be directed to the areas of best forage as poor forage will not put pounds on his sheep.

2.1.1.4. *Predation*

Predation is a problem encountered by all Woolgrowers in Idaho. Their sheep are preyed upon by coyotes, bears, cougar, bobcats, dogs, and eagles. Considering all of the sheep in Idaho, approximately 76% of the predation losses are due to coyotes (USFWS records, Boise). The Idaho Woolgrowers Association suggests that 4% is the average annual loss of sheep to predators for all operations in Idaho. This works out to about a 3% loss due to coyotes. These loss figures, along with data from field research, have been used to calculate economic effect of coyote predation in Idaho (Table 5).

Variability in Coyote Predation: Statewide loss rates fail to reflect the extreme degree of variability in the problem of coyote predation on sheep. Coyote predation rates vary substantially depending on the nature of the sheep raising operation and consequently, its capacity to avoid and offset predator losses.

Table 5. Economic losses to Woolgrowers in Idaho in 1980.

SOURCE OF % SHEEP LOSS DATA	TOTAL # ANIMALS		% ANIMALS LOST		MILLION $ VALUE	
	EWES	LAMBS	EWES	LAMBS	EWES	LAMBS
Idaho Woolgrowers Association	468,000	450,000	- 3 -		- 1.7 -	
Nass, 1977			1.3	2.3	0.4	0.6
Early et al., 1974			1.9	3.1	0.5	0.8

Sheep losses to coyotes are not as great in farm flock as range operations. Farm flocks tend to exist in a relatively protected environment. Farms at the center are buffered from coyote predation by those at the periphery and by the outlying range lands. Dogs are the major predator on farm flocks.

The majority of coyote predation on sheep occurs on the range. Range operators whose lambs are born on the open rangelands suffer the highest loss rates. A rancher, with a large rang-lambing operation, reports annual predator losses of 2–4% of his sheep with the figure rising to 6% in a bad year. In Southwestern Idaho, approximately 200,000 ewes and nearly as many lambs are spread across the open ranges. Ninety percent of the Idaho predator control program is directed toward relieving sheep losses in rangeland operations (USFWS records, Boise).

Coyote predation rates vary substantially from one year to the next. Long before predator-prey cycles were studied by scientists in Idaho, ranchers claimed that when the rabbit population reached the bottom of its cycle, coyote predation on sheep increased. According to the 'old-timers' predation problems were at their worst when the rabbit population 'crashed' in the years before 1080 was used as a general coyote population suppressant.

The ranchers in the desert area of Southwestern Idaho have experienced one rabbit population decline, since the ban of 1080. When local jackrabbit populations crashed in 1973, one rancher likened the situation to a locust infestation. Uncommonly large groups of 7–12 coyotes were seen together on the desert. As a result of high losses this particular rancher corralled his sheep with portable fencing each night. Lights, horns and guns were used throughout the night to scare the coyotes away. During the day, the men "rode armed guard" in their trucks to protect the flocks. If this situation had continued for another year, this rancher would have been forced out of business. However, by 1974, losses, although still heavy, had subsided. In the spring of 1981, this same operation suffered no losses to coyote predation. At this time, however, the rabbit population was at its peak. The ranchers are now worried about what will happen when it crashes.

The peak loss years appear to vary somewhat from one area to another. A rancher in one area claimed that 1974 was a bad year, and a large operator in an area some 100 miles east claimed that 1978 was the worst year.

Factors involved in coyote predation on sheep: The experience and energy requirements of the coyote as well as the vulnerability of the sheep are factors affecting coyote predation on sheep. The sheep's vulnerability factors are: size,

experience, natural defenses and accessibility. Accessibility may be increased because the flock is on open rangelands or because an animal is at the periphery of a flock. Gluessing (1977) showed that a number of factors that placed lambs on the periphery of a flock included: impaired mobility, lambs of infirm ewes, lone lambs, lambs displaying aberrant behavior, active lambs and lone lambs in an unfamiliar herd.

Another factor affecting predation is the size of the prey animal. In U.S.F.W.S. studies at Logan, some coyotes that refused large lambs would eat small ones. Usually, more lambs than ewes are lost to coyote predation. Ranchers claim that a ewe's vulnerability is dependent on experience as well as size. Rams are rarely attacked as they are large, have horns and are more aggressive. Ewes and lambs tend to run from predators. This behavior enhances the coyote's likelihood of attack (Lehner, 1976).

A number of researchers have suggested that coyotes are morphologically and behaviorally adapted to chase and kill prey but their skills in identifying, killing and eating prey are determined by experiences (Fox, 1969, Lehner, 1976). Coyotes evolved as predators on rabbit-rodent sized prey but through experience some learn to capture larger, more difficult prey such as sheep, calves and deer. Continued exposure to sheep or sheep carcasses may lead to sheep killing behavior. However, even after long-term exposure to sheep, not all coyotes kill them (Gier, 1968; Boggess, Henderson and Spaeth, 1980).

The spring and late summer are times of increased energy need for the coyote. In the spring these animals have their young and later in the summer the young animals have increased food requirements. Increased sheep predation is known to occur at these times.

2.1.2. Woolgrowers' management Practices

2.1.2.1. *Deterring predation*

In farm flock situations neighbors rely on each other for assistance in controlling predators. Local boys often become 'predator control agents' and are called upon if sheep losses occur. In 1973, in the desert area of Southwestern Idaho, an avid young hunter shot 15 coyotes within three miles of his home.

To avoid losses to coyotes farm flock operators may erect fences. Electrified fences are used when affordable. If predator activity occurs, farmers can respond either by bedding the sheep near the farmhouse and/or by removing them from pasture early in the fall. One farmer reported his predation losses ceased when he bedded his flock in a corral near the house. The corral was lit with flood lamps and he always left a radio playing. His sheep got so used to the arrangement that they began coming 'home' on their own in the evenings.

The range operator may employ certain management practises in order to deter predation. He may:

- avoid a 'hot spot';
- move his sheep before he had intended;
- conduct closer herding practices;
- bed his sheep in night corrals or near the wagon;
- use guard dogs or noise makers;
- utilize shooting, poisoning or denning; and
- encourage his herders to become involved in coyote control.

Many factors limit the rancher's ability to control coyotes. Ultimately, most sheep ranchers feel that coyote control is not their job. Government spatial and temporal land use restrictions limit the rancher's ability to offset losses by moving his flocks. If an area has a record of high predation rates, he may avoid it, or test it by running one band through. Although some areas have a history of predation, others are not so predictable. If unexpected predation losses occur, a rancher may move his flock early. However, he has no guarantees that losses will decrease. In the fall, once the coyote pups are grown, the coyotes can follow the flock.

In the early days of sheep ranching, herders were usually excellent trappers and marksmen. They were also very good at warding off predators. Now herders are more interested in cameras than guns. Expensive rifles are lost or destroyed. Shells were once supplied, at cost, by the United States Fish and Wildlife Service, but this practice has stopped. Animal damage control agents of the U.S.F.W.S. report that they have tried to teach herders the skills involved in coyote killing, but few herders have become proficient. The agents feel that the problem is a lack of incentive. Herders have little interest in trapping a commonplace animal like a coyote, but they are thrilled at the opportunity of snaring something as large and

fearsome as a bear.

It is not advantageous for the rancher to have his herders spend too much time hunting coyotes. A flock not only needs a great deal of attendance, but is continually on the move. Some ranchers, however, still encourage their men to kill coyotes. In the past, ranchers rewarded their herders with a jug of wine. Now they reward them with Pepsi, which they apparently prefer, and allow them to keep the pelt. In 1979, a pelt was worth $40. Of course, only a winter pelt is of value.

To facilitate optimum observation of the sheep, herders may be instructed to keep the bands in a tight formation. Ranchers hate to do this, however, as it goes against their principles of good sheep management. They damage the rangeland. If necessary, ranchers will put the sheep in portable corrals at night. However, sheep are crowded and stressed in corrals, and miss valuable hours of grazing. This practice is most detrimental when the ewes have young lambs. In the fall, when the lambs are gone, ewes are often bedded by the campwagon. At great expense, one rancher purchased two Great Pyrenees, as flock guard dogs. One ran away and the other refused to leave the wagon. Most ranchers claim that coyotes quickly become accustomed to scare devices. Ranchers always carry a rifle and shoot a coyote when they see one. On their private lands, they use "1080 sold as rat bait, some Thumensin, and lots of strychnine."

2.1.2.2. *Lambing*

Range operations have two management options where lambing is concerned. Most ranchers move their ewes into sheds to lamb. This practice is referred to as 'shed-lambing.' Other ranchers use the traditional 'broadcast-lambing' system in which the ewes remain on the open range. The ewes which are ready to give birth are 'dropped' from the main band. If a ewe is not dropped, when the band moves, she may become excited and leave her new-born lamb behind. Ranchers refer to range-lambing as a 'cheap operation.' Some ranchers use both techniques, shed-lambing early in the spring and range-lambing later.

Both lambing systems have advantages and disadvantages. Range-lambing greatly facilitates pair-bonding between mother and young, and ensures plenty of lush food and freedom from disturbance. Ranchers feel that this is the best system. However, predation and the possibility of bad weather conditions at lambing time are major problems.

On the other hand, shed-lambing avoids these problems but has other disadvantages. Ewes that have been on the open range all year become stressed when enclosed and handled. Sheds are costly to install and are only used for a short period each year. The operation is labor intensive, but only required for a short time. Finding short-term help that is skilled in assisting with the birth and handling of new-born lambs is difficult. The cost of feed is high and the incidence of disease is greatly increased in the confined and inevitably muddy shed area. The advantages of shed-lambing include freedom from predation, increased weight gain in lambs and an early lambing season. This enables the rancher who shed-lambs to be one of the first to market and therefore to get the best price for his lambs. Operators may shed-lamb some of their ewes in order to take advantage of this early market and then lamb the rest on the range. More and more operators are switching to shed-lambing, early marketing and decreased predation are the major incentives.

2.1.3. Indirect predator losses

Ranchers feel that the indirect losses to predators are as great as, or greater than, the direct losses. When bands have to be tightly herded to guard against predation, the sheep are stressed, don't have as much access to forage, and damage the range. Sheep which are corralled at night suffer not only from increased handling but also from less access to forage. The killing of a few flock members stresses the rest of the herd. This is especially true of a ewe which has lost her lamb. Sheep involved but not killed in pile-ups reportedly spend less time eating and more time "on the lookout for bear." One rancher reported that a band involved in a pile-up weighed out at an average of 10 pounds less. Decreased range availability due to predator "hot spots" is a major complaint of ranchers. The general result of these factors is a decreased weight gain in lambs. Increased costs for labor, feed and predator control devices also add to the rancher's losses.

2.1.4. Conclusion

Woolgrowers generally view the coyote as an agricultural pest in an agricultural environment. If the coyote and other predatory pests could be removed from the rangelands, more forage would be available and existing sheep would fare better. Labor problems would indirectly be lessened as more ewes could be range-lambed and possibly fewer herders would be needed. Numbers of sheep could be increased and existing sheep would have better weight gains. These factors would lower the cost of meat and wool for the American consumer. Ranchers feel that the rangelands would be enhanced since the sheep keep unwanted grasses down and can use rangelands not suitable for cattle. Herbivorous game populations would also be enhanced as they could thrive alongside the sheep in the face of fewer coyotes.

Most Idaho ranchers believe that preventive measures are necessary to alleviate predation losses and that coyote population suppression is the only realistic means to this end. To be effective this preventive control would need to be conducted over approximately 15% of the land area of Idaho. Unless populations are generally reduced, as they were in the days of toxicants, immigrant coyotes will quickly fill the void created by those killed through local controls. Most ranches have been passed down through at least one generation and the ranchers are at least vicariously associated with the heavy losses in the pre-1080 days. Some ranchers cite the year 1929, with its 5% sheep losses to predators, as a bad one. During the years of 1080 use, ranchers report that they "never saw, and rarely heard, a coyote." Compound 1080 is hailed for its economy, efficiency and ease of use in less accessible areas. "For a mere 40 cents worth of 1080 you can easily kill more coyotes in a day than you could with a helicopter which now costs $375 per hour... We're not only worried about our own expense but also that of the American taxpayer."

2.2. Controlling Sheep Losses to Coyotes in Southwestern Idaho*

A typical ADC (Animal Damage Control) manager in Idaho has been involved in the coyote control business since he was a youngster helping out his father who was the government trapper. "Things were a lot different then – everything took a lot longer and Dad had to work seven days a week to keep up. There was no radio

*Information in this section was attained through discussions with ADC personnel, Boise, Idaho.

communication and all the work was done on horseback."

Today, as in the past, the ADC managers are dedicated to "holdin' those losses" and will tell you, "the scope of ADC is actually very small. The real and only issue is controlling damage done by wild animals." The ADC managers feel that a federal ADC program is the necessary and professional approach to controlling wildlife damage.

> ...There is a need for animal damage control, and the responsibility to conduct it properly belongs with professional wildlife managers where ecological and technological understanding naturally occurs along with adequate concern for wildlife and, therefore, where the greatest influence can be exercised for a sound program that doesn't neglect wildlife (Packham, 1978).

The importance of a professional coyote control program has been stressed for many years. A USDI memorandum once suggested:

> The work can be done more expeditiously and efficiently and with the necessary safeguards to other animal life when conducted under the direction of men trained in the work (U.S.D.I., 1945).

Like its predecessors, the ADC program is involved in controlling rodents and rabbits as well as coyotes. Farmers and federal land managers are assisted in eliminating meadow mice, ground squirrels, pocket gophers and rabbits. Pocket gophers are considered to be the most damaging crop pest in Idaho. ADC agents also consider the supression of these pest populations an aid in controlling coyotes by reducing their food supply and thereby their potential density.

Predator and rodent control is a job that was originally mandated to the ADC manager by the Animal Damage Control Act of 1931. Approximately 90% of the program's resources are used for the resolution of coyote damage to sheep. Ninety percent of this effort is devoted to the range operations. ADC personnel feel that "major livestock predators can be effectively handled only by one who understands them and has time to devote to their control. Rodents can be handled effectively by farmers applying existing control methods." The ADC program encompasses 15% of the area of Idaho and the manager is responsible for approximately a half million range sheep (total count), which are spread throughout the desert and forests.

The manager's success in controlling sheep losses is assessed by both of the program's sponsors; the U.S.F.W.S. and the livestock interests. The USFWS requests a 75% resolution of predator damage complaints. According to ADC managers, this loss resolution rate has never been possible. For the Woolgrowers,

of course, no sheep losses to predation would be ideal. This is also an impossible goal. Managers, however, aim to keep sheep losses to coyotes below 2%. As noted by ADC personnel, "Ultimately, success of predator control or loss rates are the result of action by livestock managers and ADC personnel which usual brings losses down to a single digit" (Packham, pers. comm.).

The ADC program has limited resources with which to achieve its goal. In 1979, the Idaho ADC program had 18 men, $900,000, two management strategies and a limited set of control methods. The resources a manager has available to him are restricted by policy, field conditions and a concern for the safety of the men.

2.2.1. ADC management practices

2.2.1.1. *Predator control strategies*

Coyote damage is controlled by two management strategies; corrective and preventive controls. While ADC personnel suggest both strategies are essential to an economical and effective program, corrective control is not favored by either the rancher or the managers as it implies loss before action is taken. ADC personnel and government researchers also believe corrective controls only serve to create a temporary void which is quickly filled by replacement coyotes. However, ADC personnel do view this temporary void as providing critical protection to the sheep.

In preventive control, the possibility of losses is decreased by reducing the overall number of coyotes. This is the preferred strategy for a manager who is trying to minimize losses. "The business of ADC is forced to consider effectiveness and efficiency" (Packham, 1978).

Before the 1080 ban, bait stations were placed out over winter to reduce coyote populations. After the toxicant ban, non-toxic baits were used to attract the coyotes. They were then shot from helicopters. When high losses are anticipated, based on high losses in the previous year, coyote populations may also be reduced in an area just prior to sheep moving onto it. ADC personnel suggest that this method may either be effective for several years or it may not stop losses at all.

ADC managers suggest that heavy population reduction is needed in some of the Forest Service areas. They consider that a major effort in these regions could hold sheep losses for three to four years. The managers and ranchers also feel the use of 1080 is necessary in these "inaccessible and high loss areas." Aerial

gunning is considered ineffective as it can only be accomplished during the winter when there is snow on the ground and a minimum of foliage on the trees enabling the gunner to see the coyotes.

2.2.1.2. *Control methods*

The major control methods which the manager had available to him in 1980 were: aerial and ground shooting, trapping, snaring, the M-44 and a limited amount of denning. Percentage utilization, since 1973, for each of the ADC's, control methods is given in Table 6. Some of the methods are more effective than others in resolving sheep losses to coyotes (Table 6). Denning is the only tool which may have 100% problem resolution. The helicopter rate is low because it is used in rough country where it is more difficult to shoot coyotes. Traps are slow and labor intensive as are the M-44's, snaring and ground shooting. Although many years have been spent researching different control methods, the only operational results are the M-44 and a few trap modifications. "No new tools have been made available for field use."

2.2.2. **Manager's problems**

2.2.2.1. *Field Restrictions*

Control methods and priorities constantly have to be reevaluated due to changes in land use, terrain, vegetation levels, weather, vulnerability of non-target species as well as local and State laws. For example, aircraft are of limited use in rugged terrain, during bad weather and in areas of heavy foliage. Traps freeze and become inoperable in the winter. In some areas controls cannot be used in the summer due to the presence of hikers. A variety of tools are essential to accomplish the task of minimizing sheep losses effectively, efficiently and safely.

2.2.2.2. *Manpower*

Manpower is a problem as few men have the required skills. Although the District Field Assistant (DFA) is the foundation of the program, he is underpaid, has poor working conditions and lacks job security. Many DFAs are only hired part time. Ground workers and aerial gunners operate under rough conditions. The

Table 6. Percentage utilization of ADC methods.

YEAR	TOTAL COYOTES	M-44	DEN	GROUND SHOOT	FIXED WING	HELICOPTER	DOGS	SNARE	TRAPS
1973	8744	-	2	5	17	27	.7	.8	47
1974	5492	-	1	4	18	43	-	.3	34
1975	4515	2	2	4	14	75	-	.9	25
1976	5005	3	1	5	15	57	-	.5	30
1977	3325	4	.8	6	11	43	-	.1	34
1978	7551	3	3	5	12	51	-	.1	24
1979	2775	1	4	6	14	51	-	.7	23
1980	2683	2	.2	7	17	48	.7	.7	25
1980 % effective resolution corrective losses.		40	100	55	93	80	-	33	53

aerial gunners often fly with 'low-bid pilots' at low altitudes through difficult terrain and in bad weather.

2.2.2.3. *Federal Policy*

Policy changes often inhibit the ADC manager's ability to achieve his goals. These changes affect funding, management restrictions and the use of control tools. Funding reductions and inflation result in a decrease in manpower, safety and the use of available tools. As the labor force is reduced, the labor-intensive tools such as the M-44, snares and ground shooting are less likely to be used. A shortage of funds also limits the use of the more expensive tools such as the helicopter. The helicopter cost $93 per hour in 1973 but $375 per hour in 1981. Ultimately safety is sacrificed and the ADC manager cannot be as responsive to changing field conditions.

Control agents felt that a trade-off was being made in 1972 when the use of toxicants was banned. They considered that "a political decision had been made to replace a cost-effective toxicant with an expensive mechanical tool that was considered to be more environmentally sound." Generally, they viewed this as impractical. "...1080 is one of the most environmentally sound tools available for predator control" (Packham, 1978).

Some District Field Assistants expressed overwhelming approval of the switch to aircraft. One DFA said that in his many years of service "control has never been this good." Although he shot coyotes from helicopters flying over rugged terrain, he felt the method was excellent since it was "safe, fast and you get what you're after."

2.2.2.4. *Departmental support*

Since the 1960's the ADC managers have felt that they have had little support from their directorate. They believe that a professional ADC program is required, but that no one wants to take responsibility.

> The field staff need strong support from leadership at all levels. They need and deserve clear direction from the entire chain of command that accepts the responsibility and quits dodging it (Packham, 1978).

2.2.3. Conclusion

The ADC managers feel that the major factors restricting their ability to minimize sheep losses are limited funds and control methods. In 1980, they were faced with a situation wherein the constant dollar value of funding and the number of field agents employed decreased while government restrictions and costs increased. The ADC manager fears that as costs continue to rise and relative funding decreases he won't be able to hold the sheep losses with the tools he has available to him now. In addition to this, helicopters were not considered effective for summer control work in the high country (Forest Service summer range), where the greatest sheep loss rate occurs. The use of Compound 1080 is viewed as a practical solution to both the problems of limited funding and limited access. However, ADC personnel note that "a general and broad use of 1080 is not envisioned."

2.3. Concern with the Environmental and Economic Effects of Sheep Ranching and the ADC Program*

It is claimed by many that the private hunters and trappers are the 'Environmentalists' in southwest Idaho. Private trappers strongly object to the killing, by federal control programs, of fur-bearing animals, such as the coyote. They are critical of the practice and the methods. Those spoken with suggest that the federal program economically inhibits private trapping programs. They also disapprove of the methods used in the federal program, and suggest their trapping methods of very species specific.

Individuals involved in the federal control program have expressed concern over a lack of specificity in some ADC methods utilizing toxic substances. A District Field Assistant complained about the discrepancy between laboratory research and field application of control methods. He reported that in order for 1080 bait stations to be coyote specific he "was supposed to leave not more than 16/1000 of a gram of 1080 in each pound of meat." Although he went to extreme efforts in an attempt at precision, he concluded that it was "mechanically impossible to treat a carcass in the field so that each pound of bait material contains the specified amount of 1080." He also pointed out that even if the 1080 was evenly distributed predators tend to gorge themselves when they find food. He concluded:

*Information in this section attained through discussions with trappers in southwestern Idaho, backpapers, a long term resident of the West.

"to state that these baits had no adverse effects on non-target species would require a long look in a crystal ball" (Randall, not dated).

Some private individuals object to the presence of sheep in 'wilderness' areas. One hiker explained it this way. "I was on a long hike in a beautiful and remote area. The sheep in the alpine meadows were picturesque, but it bothered me that they were trampling the vegetation. More disturbing was the shit in the streams - the only source of drinking water around. We were warned not to drink from anything but directly glacial fed waters because several people had become violently ill from drinking contaminated water. Is this someone's idea of a wilderness area?

George Jorstad, an American who personally experienced the West during the period covered by this paper, responded to an early draft with the following:

The Case Against the Sheep

The wars between the sheep and cattlemen of the early West were very real. There were such wars - real, shooting engagements, with dead on both sides.

And there was a very good reason for these wars. Sheep contaminate range lands. The contamination comes from an odor, a scent, left by sheep wherever they go. My Britannica has this to say on the subject:

> Between the two middle toes (of the sheep) in most species, is lodged a deep glandular bag having the form of a retort with a small external orifice, which secretes an unctuous and oderous substance, this tainting the herbiage or stones over which the animal walks.

This smell, or stench, carries for miles. Cattle or horses will not graze on lands polluted by the stench of sheep. I'll give you this instance: Along about 1913, two brothers trailed a herd of about 400 horses from a location in eastern South Dakota to new homesteads in Saskatchewan. In the coarse of this drive they came into sheep country, and their herd would have none of it. The horses were nervous and wouldn't eat the grass.

At the beginning of one day, a mare in the herd, dropped her foal - a little black-trimmed buckskin. I know about this because five years later I acquired this buckskin. Ordinarily, these drivers would have slowed down and fed their horses, giving the foal a chance to dry off, and find his legs. But they were in SHEEP COUNTRY, and the herd had to race 75 miles to uncontaminated pastures.

Over-grazing and short-cropping of grasslands, you mention something about, but not this contamination. Your back-packer told about sheep polluting drinking water, which is true enough, but the back-packer, wherever you find him, is an interloper in the country with no ecological relationship to the wilderness he professes to love. He is always urban and academic and his observations have more to do with himself, as subject, amidst wild and unfamiliar scenes, then with the wilderness he is viewing.

No objection can be found with the sheep considered as a farm animal, along with pigs, and poultry. But when they come in thousands, like the great droves that ranged all through the West, as happened from the 1890's up until 1930's and later, the story becomes very different. The wagons, serving as hearth and home to the herders, were covered much like prairie schooners of the pioneers, and stood out like sentinels on the great landscapes proclaiming the Kingdom of the Sheep. Each drove numbered up to about 2,000 head, and they moved like swarms of locusts from locality to locality leaving a wasteland behind them.

And then there is this about the animal. Next to the turkey, the sheep must be considered the stupidest creature on earth. You should remember that the sheep of the Wool Growers Association, is the end product of intensive breeding in the pens and paddocks of Britain, where every means of bringing about the combination - much meat and a fine fabric (fatty chops and Scotch tweeds) was the end and aim. So you have a synthetic animal, brought about artificially this because the creature could never have evolved naturally, and so, stands as a creation of the breeder's art. Or is breeder's science better?

Unlike others of the Ovis family, such as the Big Horn, the creature was brought into this world without any defenses. It couldn't run, couldn't fight off any enemies, was practically directionless, and whether it was a storm it was eluding, or fleeing from a predator, its method was to circle, crowd in upon the flock, and find refuge under the bodies of its fellows. Hence, its tendency, as your Idaho sheepman said, when any kind of danger threatens, is to pile up. And so it happens that, as in the case of a storm — snow, hail, rain, or from an attack by predators, or from panic, due to any of a number of causes, the great loss to the flock comes from trampling and smothering.

I was thinking about this, along with other characteristics of the sheep (and the coyote) while flying over southern Idaho a few days back — Nevada, Utah, Wyoming, and South Dakota — the Great Basin and the High Plains, where this foreigner, this alien to everything that is the American West, this cripple of an animal that never, never could have come about by itself, seeks to live and dominate. Wool Growers and Sheepmen's Associations, whether in Idaho or Wyoming, would have these vast territories made over to accommodate this creature. They have been successful in eliminating the grizzly bear already. The big and little cats, the big wolf and the other bears, and the eagles — all have been reduced to impotence as species. They exist, but that is all that can be said for them. There remains only the:

> Sneakin' coyote, Cowardly coyote
> Slinkin' coyote
> Mangy coyote —
> That living, breathing allegory of Want that Mark Twain tells about.

Was there ever a Western thriller yet, either as shown on film or told about in print, but that the bad guy in it, the villain, wasn't called by one of these names, or something like it, whereupon he was floored by the hero of the piece with a smash on the jaw?

What did this tawny little wolf ever do to earn this kind of reputation? His little cousin the fox didn't. He came off pretty well. He is characterized as being sly, cunning, tricky, foxy, but with no approbrium attached. He stole the farmer's ducks, ran off with a goose now and then, raided the hen coup, and in myth and story, won approval for it.

The coyote, on the other hand, did none of these things. He was never a barnyard marauder. Neither by night nor day did he close in on human habitations. There isn't an instance on record of his harming a human being. His precincts were the hills beyond the field, the gullies in the forest, and the broken lands beyond them.

A living, breathing allegory of Want? Probably no creature on earth was, and is, a better provider for his needs and better equipped to maintain himself in the world than this "sick and sorry-looking skeleton in a gray wolf-skin... with an expression of forsakeness and misery, a furtive and evil eye... always hungry, out of luck, and friendless," that Mark Twain found in Nevada. And it didn't help any when he said, "I got well acquainted with his race afterward and can speak with confidence." It would be nearer the truth, I think, that his acquaintance with the coyote was gleaned from talk in the saloons of Virginia City, where he found notions appealing to his readers back east. His portrait of the coyote, like that of his whole experience in the wild and wooly West was more in the nature of a caricature of what he saw and felt rather than a picture of reality. Actually, the coyote is a very alert hunter. His pointed ears and sharp muzzle were designed (and not by clever Scottish breeders) to detect by smell and sound the mole and gopher in their tunnels and the hiding places of the squirrel and rabbit. These sources of food failing, there were insects, grubs, and bits of offal to be found.

It is true that his garb did blend well with the sage brush and the gray-brown earth, and it is true, as well, that he was slitherly and cowardly in keeping out of range of the guns that would kill him. Also, he learned to avoid pretty well the steel traps and sniff out the poisons of ranchers and government hunters. For which reasons, I guess, he was branded a coward.

But then there was this: as compared to the fox, the coyote is a "pack" animal. The vixen and her fox, or the fox and his vixen, operate singly or in pairs, and are mostly silent, maybe a small bark now and then, whereas the coyote and his or their pups of the season, or some from the season before, hunt as a unit at certain times of the year, and at such times engage in a concert of eerie yaps, barks, and howls. There is something very primitive and wild in these concerts, that is fearsome to other animals. A dog will bristle and growl; a horse, or donkey will prick up its ears and stop munching for a time; and a man, instinctively, will think of his gun.

A few coyotes can put up a tremendous barrage of sounds. They are ventriloquists, choristers, and soloists, and the medley a few put forth, or many (it is impossible to tell how many) truly, inspires an awe and fear that goes far beyond the danger threatened.

Such a pack, attacking sheep, seem to kill in shear delight. It isn't hunger that motivates this killing so much, as glee in slashing warm, wooly throats; and it is this murderous tendency of the coyote that has brought forth such a hue and cry from the sheep men. No rancher, probably, would very much mind giving the pack a ewe or two. All understand, and will make allowances to animals killing for food, but the coyote, in the case of sheep, at least, seems to kill as an avenger. A few gulps from one throat, and the coyote is off for a few gulps from another one. I have seen pictures of a whole landscape strewn with the bodies of sheep left uneaten excepting for the slashed throats. To the sheep men, and I think, to your little old ladies in tennis shoes in New York, such killing is nothing but murder, and so, is resented by all, even the common citizen and tax payer who doesn't seem to mind contributing to the keep of government hunters and staffs of scientists probing the menace of the coyote.

At the present time in Trinity County, California, the sheep men and Wool Growers Association people, are demanding that the County employ five year-round hunters, equipped with all the gadgetry of extermination known to technology to come to their aid. They report their losses too great, and claim that the governments — County, State, National — are responsible.

Nonsense, and worse. As I look at it, the inept sheep are an invader to everything that is the West — its mountains, its deserts, its grassy slopes. And along with the terrain, there are the life forms natural to it, including the predators.

And in all fairness, if the sheep men want to run their sheep by thousands on the open range, they must accept that range as it is. Or is it, that they expect the country to be made over to accommodate this despicable alien?

I'll end this by saying that your Canis Latrans must be considered the truest of all Americans. May he forever defend our ranges from the pest that is the sheep.

In San Francisco there is an article entitled "The Herding Day" that appeared in the Atlantic Monthly years ago (like in the 1930's) that, as I remember it, is very interesting. I don't remember the author. There is a religious matter that pops up in the connection with the sheep. For instance, the shepherd - the flask - the lamb - the lamb of God - the epigram, 'the meek shall inherit the earth' - weakness, innocence, debility - are Christian sentiments and the sheep for centuries have been emblem and symbol of weakness and piety.

These attitudes and sentiments are still with us - and, it would seem, work in favor of the sheepmen. Christians, everywhere, view the sheep kindly as a result of biblical training — Does this thinking affect lawmen?

3. THE 'NATURAL' SYSTEM

3.1. Feeding behavior

Jackrabbits are the major prey of coyotes in Southcentral Idaho (Curlew Valley Research site) (Clark, 1972). Hoffman noted that jackrabbits were used in proportion to their abundance and availability. When the rabbits were not abundant, they were still available due to their aggregating behavior (Hoffman, 1979). Rodents are also a major food. Hoffman (1979) found that the rodents were eaten in proportion to their total biomass. In the coyote diet, rabbits and rodents are supplemented by carrion, especially during the winter.

Annual, seasonal and geographic variations in coyote feeding behavior are affected by variability in the abundance and availability of major prey items. ADC personnel note that "exposure to sheep" is also a key factor. Annual variations in coyote food habits in Curlew Valley were recorded for years of low (1968), medium (1969) and high (1970) jackrabbit abundance (Table 7). Each year, the major dietary constituent (% frequency of occurrence) was lagomorph. In the year of highest rabbit density, coyotes ate almost nothing but lagomorphs. During a period of medium jackrabbit density, rodents were very nearly the only other prey item, while at low rabbit density, domestic animals "probably carrion in the case of cattle" were second in importance and rodents third. The greatest occurrence of sheep in the coyote diet was in the year of low jackrabbit density (1968). Sheep constituted 6% (by occurrence) of the winter diet.

From 1973-1975, during the lowest recorded point in the jackrabbit cycle, Hoffman (1979) found that sheep constituted 2.7% (by volume) or 6% (by occurrence) of the annual coyote diet in Curlew Valley (Table 8). During this period of low rabbit abundance, Hoffman (1979) noted that "Nuttall's cottontail and pocket gophers are important alternate prey in Idaho."

Seasonal variations in coyote feeding patterns were observed by Clark (1972) and Hoffman (1979). During the winter, rabbits and carrion were major foods, while in the spring and fall rodents were the major prey. In the autumn, grasshoppers and crickets were heavily consumed. Hoffman (1979) noted that: "Sheep were an important food item only during the spring lambing period in May" (Table 9). As emphasized by ADC personnel, the coyotes greatest exposure to sheep is during this short period in the spring.

Table 7. Frequency of food items in winter coyote stomachs from Curlew Valley vicinity.

FOOD ITEM		PERCENT FREQUENCY OF OCCURRENCE		
		1968	1969	1970
		Low rabbit (41)[a]	Med. rabbit (61)	High rabbit (84)
Jackrabbits		72[b]	85	95
Mice (Microtus and Peromyscus spp.)		13	22	2
Other rodents		3	25	2
All rodents		16	26	3
Deer		6	0	0
Game birds		3	0	0
Other birds		0	3	3
Domestic turkey	carrion not distinguished	10	0	0
Cattle	carrion not distinguished	16	0	2
Sheep	carrion not distinguished	6	0	2
All livestock	carrion not distinguished	28	0	3
Vegetation		0	3	2
Unidentified materials		3	3	2
Empty stomachs[c]		22	33	21

[a] Total number of stomachs examined in parentheses.

[b] Percentages of stomachs containing food.

[c] Percentages of total stomachs examined.

Table 8. Year-round coyote feeding patterns in Curlew Valley, Utah and Idaho, September 1973 to May 1975 (the lowest point in the jackrabbit cycle).

	UTAH (1,628)		IDAHO (666)	
	Percent occurrence [1]	Percent volume [1]	Percent occurrence [2]	Percent volume [2]
Mammal [3]				
Lagomorph [4]	71.3	63.0	40.2	24.2
Lepus californicus	55.3	52.0	16.5	11.0
Sylvilagus spp. [5]	14.0	9.1	19.2	10.9
Rodent	58.8	25.0	67.7	37.8
Livestock [4]	13.7	7.0	32.0	17.5
Cow carrion not	12.8	6.0	27.5	14.8
Sheep distinguished	1.2	0.6	5.8	2.7
Deer	0.1	0.1	13.4	9.4
Bird	12.6	0.6	12.6	2.5
Invertebrate	24.7	2.4	20.6	2.9
Plant material	17.3	1.4	31.6	4.9

[1] Unweighted monthly means.

[2] Unweighted seasonal means.

[3] Includes unidentified mammal and species of minor importance.

[4] Includes unclassified items.

[5] *S. nutallii* and *S. idahoensis*.

Table 9. Seasonal food habits of coyotes in Curlew Valley, Idaho, spring 1974 to spring 1975 (the lowest point in the jackrabbit cycle).

Food items	1974 March - May (161)[1]		1974 June - Aug. (157)		1974 Sept. - Nov. (165)		1974-75 Dec. - Feb. (73)		1975 March - May (110)	
	Percent occurrence	Percent volume	Percent occurrence	Percent volume	Percent occurrence	Percent volume	Percent occurrence	Percent volume	Percent occurrence	Percent volume
Mammal[2]	98.8	96.1	94.3	81.5	97.0	84.2	98.6	93.7	100.0	95.5
Lagomorph	27.3	13.6	40.8	19.0	31.5	19.0	52.1	36.2	49.1	26.1
Lepus	8.7	6.5	15.3	8.6	14.5	9.7	24.7	17.0	15.5	8.2
Sylvilagus	14.3	5.7	19.7	9.3	11.5	7.3	24.7	15.5	30.0	16.5
S. nuttallii	7.5	3.2	12.7	7.2	6.1	3.4	17.8	10.0	18.2	10.8
S. idahoensis	5.0	2.5	3.8	1.3	4.8	3.7	8.2	5.5	4.5	1.5
Rodent	75.2	45.0	75.2	46.7	72.1	36.6	47.9	19.1	76.4	43.7
Livestock	29.2	13.8	15.9	8.9	30.9	16.4	50.7	29.1	32.7	18.0
Cow	21.1	8.0	11.5	7.2	25.5	13.7	50.7	28.6	23.6	11.2
Sheep	9.3	5.8	5.7	1.7	6.7	2.7	1.4	0.5	9.1	6.8
Deer	28.0	23.7	3.8	2.8	15.8	10.3	12.3	7.0	12.7	7.4
Bird[3]	11.2	1.8	20.4	5.2	12.1	1.0	6.8	3.4	10.9	0.5
Galliformes	0.6	0.7	1.9	1.0	tr	tr	2.7	3.4	1.8	0.4
Passeriformes	1.2	tr[6]	3.8	3.2	1.8	tr	-	-	-	-
Eggshell	3.7	0.1	8.3	tr	0.6	tr	-	-	-	-
Reptile	0.6	0.3	2.5	0.2	1.2	tr	-	-	0.9	tr
Invertebrate[4]	7.5	0.5	51.0	11.0	23.0	1.3	-	-	10.0	tr
Orthoptera	3.7	tr	35.0	2.9	17.6	0.6	-	-	6.4	tr
Coleoptera	5.6	0.3	30.6	7.4	4.8	0.5	-	-	4.5	tr
Vegetation[5]	30.4	1.3	27.4	2.1	46.7	13.5	21.9	2.7	30.9	4.3
Seeds and fruit	11.8	tr	9.6	tr	21.2	7.5	1.4	tr	8.2	1.7
Grass	17.4	0.6	12.7	1.0	19.4	1.7	13.7	1.2	18.2	0.5

[1] Number of scats in sample.

[2] Includes small amounts of porcupine, badger, fat residue, and unidentified mammal.

[3] Includes trace amounts of sharp-shinned hawk and unidentified bird.

[4] Includes small quantities of scorpion (Vejovis), diptera and unidentified invertebrate.

[5] Includes woody stems.

[6] trace (< 0.1%).

The coyote's feeding behavior is considered detrimental in some areas while it is valued in others where it feeds on crop-damaging rabbits and rodents. Coyote feeding behavior changes with habitat as different vegetation types are inhabited by different prey species.

Ecologically distinct habitat types in Curlew Valley, Southcentral Idaho, are illustrated in Figure 3. During a low point in the jackrabbit cycle, Hoffman (1979) studied the food habits of coyotes in the Valley. Jackrabbits were only found in the range-improvement areas, where they were the major prey. Pocket gophers, ground squirrels and deer were eaten in the juniper stands. Pocket gophers and ground squirrels were also "important dietary items" in the highly agriculturized eastern arm along with "invertebrates (which) composed 20% of the diet." While coyotes do appear to have distinct food preferences, ADC personnel stress the importance of the opportunistic nature of these habits.

3.2. Coyote population biology

From 1972 to 1980 the number of coyotes in Idaho and throughout the western USA have remained constant (Figure 4). Comparable data are not available for the period prior to 1972. Annual and geographic variations in coyote densities exist within this relatively constant trend.

Coyote densities varying between 0.1 - 0.9 animals per square kilometer (km) have been observed in a variety of studies conducted throughout the West. Davison (pers. comm.) reports an average population density of 0.4 coyotes per square km in Idaho. Coyote densities change as a result of the demographic mechanisms of natality, mortality and emigration. Food levels, weather and behavior all influence these mechanisms of change.

3.2.1. Demographic Mechanisms

3.2.1.1. *Natality*

A linear relationship has been shown to exist between coyote natality rates and jackrabbit density in Idaho (Clark, 1972; Knowlton, 1981). Behavior also influences rates of coyote reproduction (Knowlton, 1978). Lab tests have established that the reproductive rate of subordinate coyotes is inhibited. Field and lab studies have also noted that coyotes will kill all pups that are not likely related.

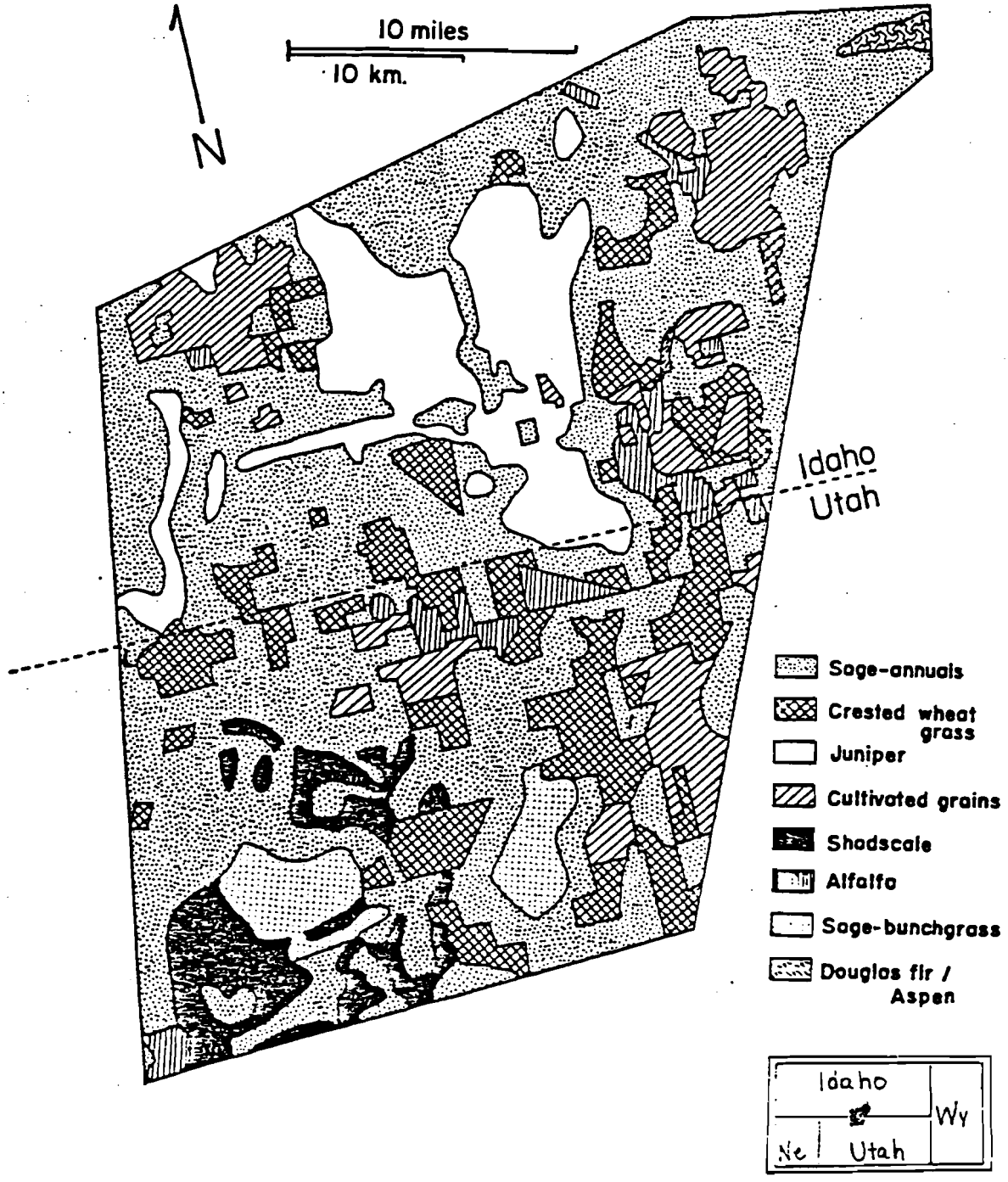

Figure 3. The spatial distribution of eight habitat types in the Curlew Valley study area.

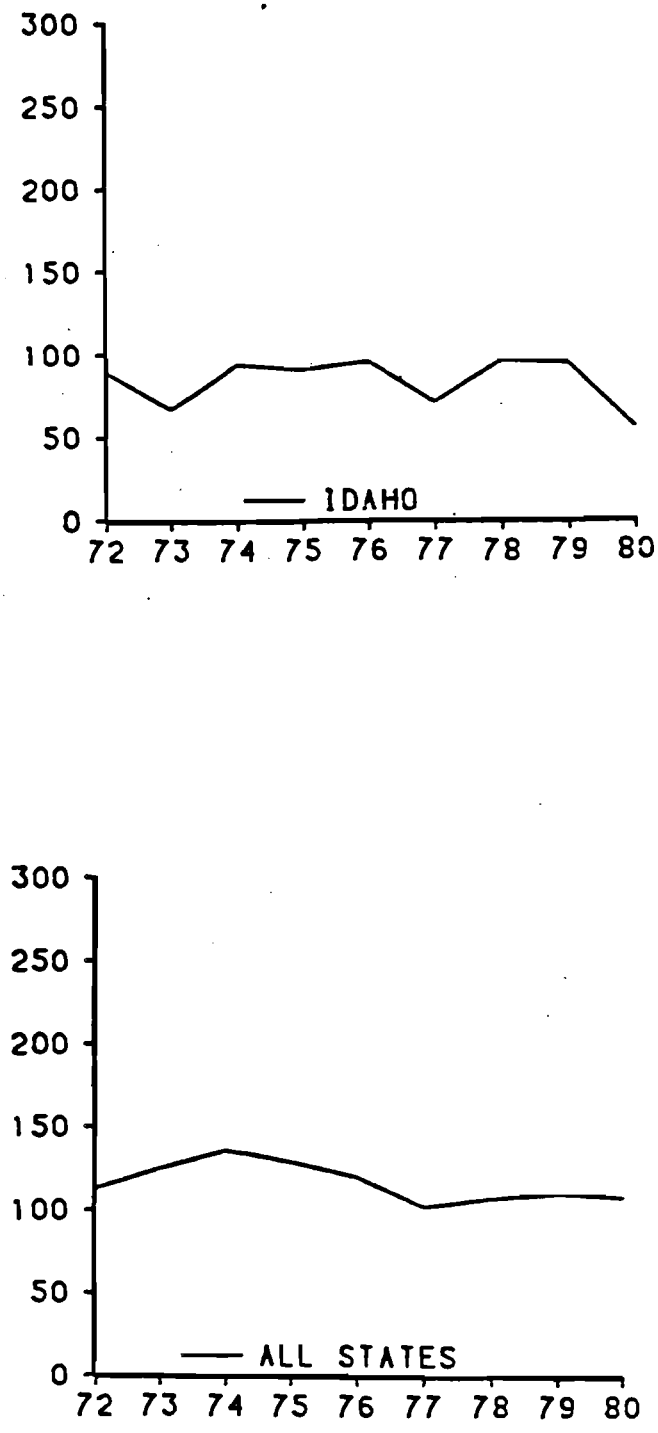

Figure 4. Trends in statewide coyote indices, 1972-1980.

The most variable reproductive factors are litter size and the percentage of ten-month old females that breed. A summary of birth rates is given for three areas with different levels of prey (Table 10). These are all areas with population controls. Knowlton (1972) has suggested that in a "stable" population (light controls) 50% of the females produce 4.5-5.0 young each.

3.2.1.2. *Mortality*

Knowlton (1978) suggests that annual mortality rates vary from 35-60% of the adult coyotes. This figure may rise as high as 76% in areas of intensive coyote controls. The average loss rate for pups between birth and 5-7 months of age is 57%.

Although food levels are an important factor in coyote mortality, the effects are rarely visually apparent. Emaciated coyotes have rarely been observed in the wild (Murie, 1940). Nutritionally deprived females have been known to eat their young (Knowlton, 1978).

Humans cause 71-95% of all coyote mortality (Table 11). Human-caused mortality in areas of light or heavy coyote control varies little from the mean of 88%. In areas of light controls, Knowlton (1978) suggests that young animals are killed when they emigrate from protected areas to locations where they are more vulnerable. In an area with no organized coyote control, Weaver (1977) noted a particularly high mortality rate for young females. In enclosure studies, subordinate animals have been killed by dominant ones. Knowlton suggests that in the 'natural' habitat the subordinates would disperse rather than be killed.

3.2.1.3. *Emigration*

Emigration rates have been shown to increase with a decrease in food levels (Todd and Keith, 1976). As food levels decrease, aggressive behavior increases and subordinate animals emigrate (Bekoff and Wells, 1980).

Roy and Dorrance (1978) showed that 83% of the adult coyotes remained on their home range while 71% of the juveniles emigrated. The emigrating subordinates are likely to occupy poorer quality habitats. Davison (1980) noted:

> The dominance rank of an individual can be expressed in terms of the distance it has moved from its place of birth or in terms of the quality of the habitat it occupies, or both. Dominants are close to their place of birth in prime habitat, while subordinates, forced to emigrate, occupy areas in

Table 10. Composite sample of birth rates from populations with predator control.

STUDY	% YEARLING OF FEMALE POPULATION	% YEARLINGS WHICH BREED	% ADULTS WHICH BREED	TOTAL % FEMALES PRODUCING YOUNG	FOOD LEVEL	X LITTER SIZE
Gier, 1968	35 - 45	65	83	75	High rodent density	6.4
		10	60	36	Low rodent density (severe winter)	4.5
Clark, 1972		49 - 70	87	55 - 73	High jackrabbits	
Nellis and Keith, 1976		14	94	43 - 54	Low snowshoe hares	5.3

Table 11. Summary of results of four telemetric coyote mortality studies, to show the percent of deaths that are man related. Wyoming and Idaho are "light control" areas.

Location and year	No. instrumented	% known dead	% deaths man-related
Laredo, Texas[a]			
1974	36	19	100
1975	28	57	79
1976	30	43	44
Total	94	38	71
Jackson Hole, Wyoming[b]			
Dec. 1973	2	100	100
Apr. 1974	27	41	100
Sep. 1974	20	55	91
Sep. 1975	18	39	71
Aug. 1976	25	40	100
Total	92	45	93
INEL, Idaho[c]			
1975	22	48	100
1976	29	34	90
1977	49	51	96
Total	101	44	95
Curlew Valley, Utah			
1972-73[d]	87	60	100
1976[c]	35	46	90
1977[c]	28	71	90
Total	150	59	93
Grand Total	437	48	90
Mean Percentages		47	88

[a]Unpubl. data from H. Leroy Anderson on file F&WS, Laredo, Texas

[b]Tzilkowski (1980)

[c]Davison (1980)

[d]Knudsen (1976)

> poorer quality habitats. A decrease in coyote density could be expected to have a similar result to an increase in food levels whereupon coyote behavior is modified and emigration decreases.

Davison (pers. comm.) suggests that the home ranges of female coyotes in Idaho are 18 km^2 and those of male animals and juveniles somewhat larger. Of course size of home range is habitat dependent. Approximately 15% of the coyotes are thought to be nomadic (Bowen, 1978). In relatively unexploited populations emigration begins in September or October and is a gradual process that lasts throughout the winter (Robinson and Cummings, 1951).

3.3. Other Wildlife Relative to the Coyote Population

In Southcentral Idaho, coyote density is hypothesized to be limited by the abundance and availability of jackrabbits and rabbit density is by the number of coyotes. Knowlton (1978) suggests that this is a "neat servomechanism whereby coyotes influence their own density through their impact on a primary food item."

The correlation between coyote and jackrabbit densities is noted in Figure 5. Density changes occur in a cyclic fashion with a periodicity of 9-10 years. The amplitude between the lowest jackrabbit density in 1975 and the highest in 1981 is 30-fold. Commensurate with this was a 16-fold change in coyote numbers.

The jackrabbit cycles are thought to be caused by increased coyote predation on juvenille jackrabbits. Knowlton, (pers. comm.) notes "... a positive relationship exists between predation loss of juveniles... and jackrabbit density." An increasing number of juvenile rabbits are killed as the lagomorph density rises. The result is a numerical response in the coyote population. The rising number of predators consume increasing amounts of prey. Finally, the rabbit population stops increasing and begins to decline. It is suggested that each coyote would only have to kill 1.3 juvenile jackrabbits daily for this to occur (Knowlton, pers. comm.). Wagner and Stoddart (1972) have suggested that the rabbit population is once again released as the coyote density rapidly declines in response to a diminished food supply.

The jackrabbit population cycles have also been noted by local residents. The reports indicate that these cycles occur over a broad area of Southern Idaho.

> The trends observed in our study area appear ... to have been paralleled by the jackrabbit population over a broad area of southern Idaho, western Utah, and northern Nevada. ... Synchrony has not been perfect, however, for we observed populations, which were one or two years out

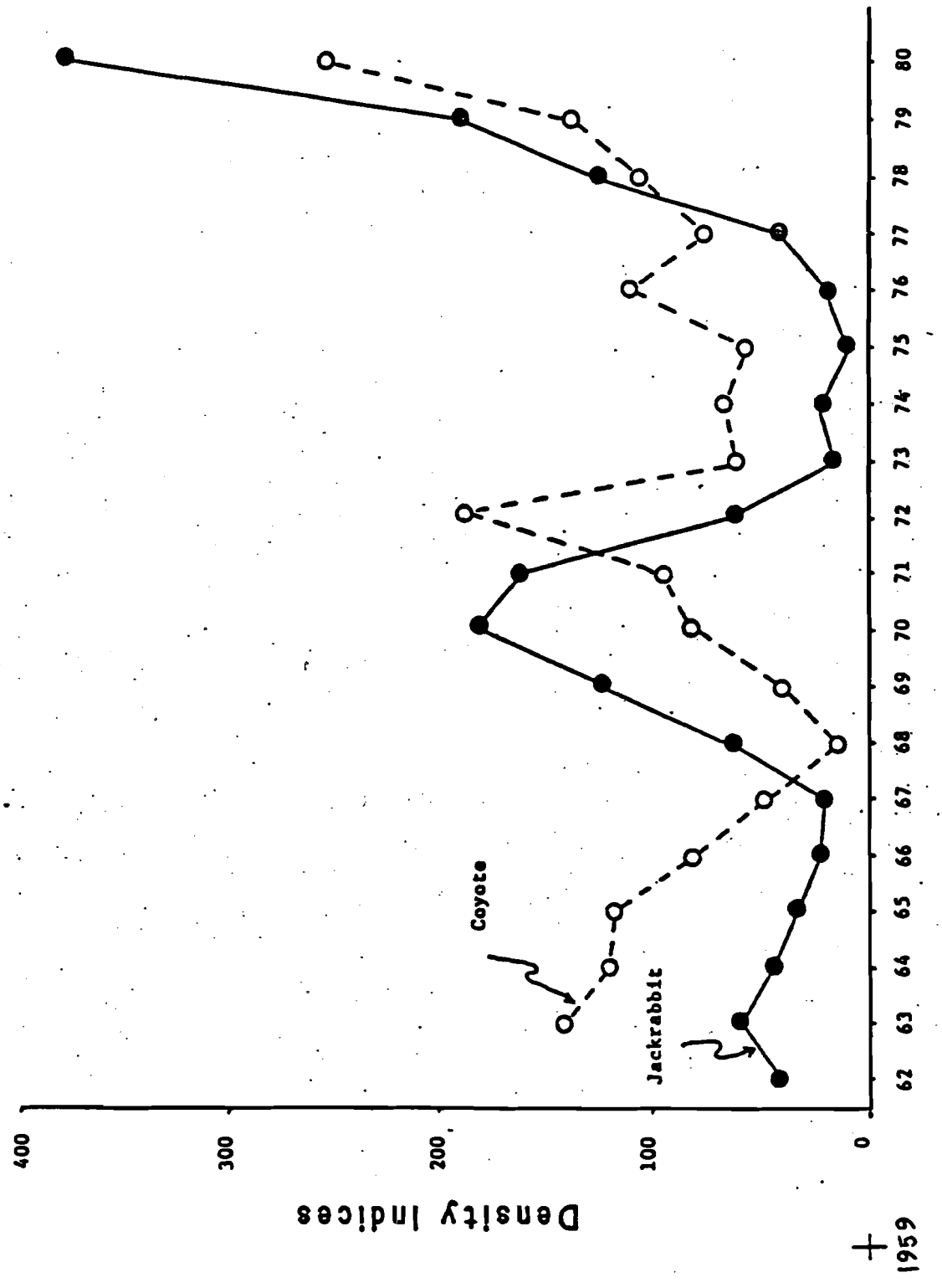

Figure 5. Coyote and jackrabbit cycles in Curlew Valley, southcentral Idaho.

> of synchrony with each other, in intermountain valleys in this region (Warner and Stoddart, 1972).

Clark (1972) noted that cyclic fluctuations in jackrabbit populations in Curlew Valley were observed at the turn of the century by Palmer (1897) and Nelson (1909).

Very little is known about the dynamics of the coyote-ungulate system. Fall hunter-kill and winter carrion are a major coyote food source, particularly in the north. Coyotes are capable of killing a deer, particularly if it is at a disadvantage. Whether coyotes can limit ungulate populations is controversial.

Coyote population fluctuations appear to have reciprocal effects on skunk, badger, fox and bobcat populations. Bobcat numbers increased in Idaho in the late 1940s when coyote populations declined (Wagner, 1972). Robinson (1961) noted that as coyote populations decreased, bobcats began to inhabit new areas. Wagner (1972) suggests:

> The implication seems to be that interspecific population regulatory processes exist between these larger species in the same trophic level, with perhaps the larger Canidae the more aggressive, dominant forms. It is uncertain whether the interactions are direct, aggressive ones, or whether they are based on competition for a common food supply.

3.4. Conclusion

Food habit studies indicate that coyote feeding behavior is not a static phenomenon. Feeding behavior varies both temporally and spatially. In Southcentral Idaho, food habits appear to vary based on the abundance and availability of lagomorphs and rodents. Food levels and coyote behavior are both important factors in the regulation of coyote densities. Available evidence indicates that both coyote densities and feeding behavior play key roles in the population dynamics of other animals.

4. THE DISTURBANCE EXPERIMENTS

As long as there exists or is some record of an undisturbed or relatively 'natural' population, a disturbed or managed population offers an opportunity to gain a better understanding of the parameters inherent in the dynamics of the system. Through management actions, serving as disturbance experiments, we become more aware of the variability in the system and gain some understanding of its resilience and the limits of this resilience. As the variables in a system are restricted, the parameters begin to change and the system becomes more vulnerable to unexpected events.

Two studies have been done which illustrate some of the effects of coyote population control on the mechanics of coyote populations. In a 1972 study in Texas, Knowlton compared recruitment rates for differently controlled areas. In the areas of intense control, a larger percentage of the females bred and reared larger litters (Table 12).

In Southcentral Idaho between 1975 and 1978 Davison (1980) conducted a study of the demographic effects of coyote population control. The managed area (1650 km^2) had "substantial" (possibly 40-50%) annual coyote removal. The 'natural' population (1225 km^2) was 100 km away in an area with no organized control program. Overall coyote feeding patterns and prey species abundance were comparable in both areas as were other carnivore populations.

The Davison study displayed that there was no significant difference in spring or fall coyote densities or annual survival rates for the two populations although kill rates were substantially higher in the managed population (Table 13). Recruitment rates were related directly to hunting (control) mortality. Emigration rates as well as nonhunting losses were inversely related to hunting mortality.

A 50% higher adult kill rate in the managed area was offset by a higher rate of nonhunting mortalities in the 'natural' population. A 350% higher juvenile kill rate was partially offset by significantly higher nonhunting mortalities. When emigration rates were included the loss in the managed area was only slightly higher than that in the 'natural' area. These slightly higher overall losses in the managed population were offset by a slightly higher fall recruitment.

Emigration of coyotes from the 'natural' population peaked during September through October and continued throughout the winter. Emigration from the managed population was concentrated during December through January. Fewer animals emigrated from the managed population and a greater proportion of those

Table 12. Differential recruitment rates in heavy and light coyote control areas.

	Heavy control	Light control
% females breeding	62	50
X litter size	6.9	4.3

doing so survived (Figure 6). The result was the same number of surviving emigrants from both populations. In the 'natural' population the coyotes remaining alive on the study site weighed the most [based on body weight at the time of initial capture], those which died on the site were lighter and the emigrants were the lightest (Table 14). Davison (1980) noted:

> Body weight is an indicator of general health and physical condition, and may be an approximate indicator of social rank in coyotes (Knight, 1978). ... Based on body weight at the time of capture, juveniles remaining alive within the INEL (control) population did weigh significantly more than emigrators, and, therefore, residents may have been dominants or at least individuals in better physical condition.

In the managed population the weights of the animals remaining were no different from those which died or emigrated. However, the weights of coyotes remaining in the managed population were significantly lower than those in the 'natural' population.

The results of Davison's study showed that "substantial" levels of winter population reduction resulted in no change in spring population density. Control losses merely supplanted 'natural' population reduction mechanisms. On the surface it would appear that nothing had changed as a result of population reduction, in fact, there were some important differences between the managed and the 'natural' population. A number of these were: decreased nonhunting mortalities, a slight increase in recruitment, decreased emigration and a lower average body weight in residents — a potential indicator of less healthy animals. Available evidence indi-

Table 13. Survey of population parameter estimates (SE) for coyotes in Curlew Valley (managed) and at the INEL ("natural") area, 1975-1978.

Parameter	Average Estimates			
	Adults		Juveniles	
	CV	INEL	CV	INEL
LOSS RATES				
Overall				
Total Mortality, $(1-\hat{S})$, $\hat{M}$	0.53 (.11)	0.49 (.12)	0.77 (.07)	0.55 (.16)
Hunting, $\alpha(1-\hat{S})$, $\hat{K}$	0.49 (.11)	0.41 (.10)	0.69 (.07)	0.43 (.13)
α	0.93 (.05)	0.83 (.06)	0.89 (.05)	0.78 (.06)
Nonhunting, $\hat{M}-\hat{K}$	0.04 (.03)	0.08 (.04)	0.08 (.04)	0.12 (.05)
In Situ				
Total Losses, $\hat{T}$	0.43 (.11)	0.32 (.10)	0.85 (.05)	0.70 (.12)
Mortality, $\gamma\hat{M}$	0.43 (.10)	0.32 (.10)	0.57 (.07)	0.22 (.05)
γ	0.81 (.08)	0.65 (.08)	0.74 (.07)	0.40 (.07)
Hunting, $\beta\hat{M}$	0.39 (.10)	0.25 (.07)	0.54 (.07)	0.12 (.05)
β	0.74 (.08)	0.51 (.08)	0.70 (.07)	0.22 (.06)
Nonhunting, $\gamma\hat{M}-\beta\hat{M}$	0.04 (.03)	0.07 (.03)	0.03 (.02)	0.10 (.04)
Surviving Emigrators, $c\hat{S}'$			0.08 (.03)	0.15 (.07)
c			0.33 (.11)	0.33 (.11)
Emigration, $\hat{E}$			0.31 (.07)	0.50 (.07)
	Curlew Valley		INEL	
RECRUITMENT RATES				
P_f	0.88 (.03)		0.78 (.04)	
P_s	0.78 (.04)		0.76 (.04)	
DENSITY				
Scent Station Indices				
Spring	6.8		12.4	
Fall	45.9		49.6	
Isotope Tagging (Fall 1977, 1978)	0.21 km^{-2}		0.30 km^{-2}	

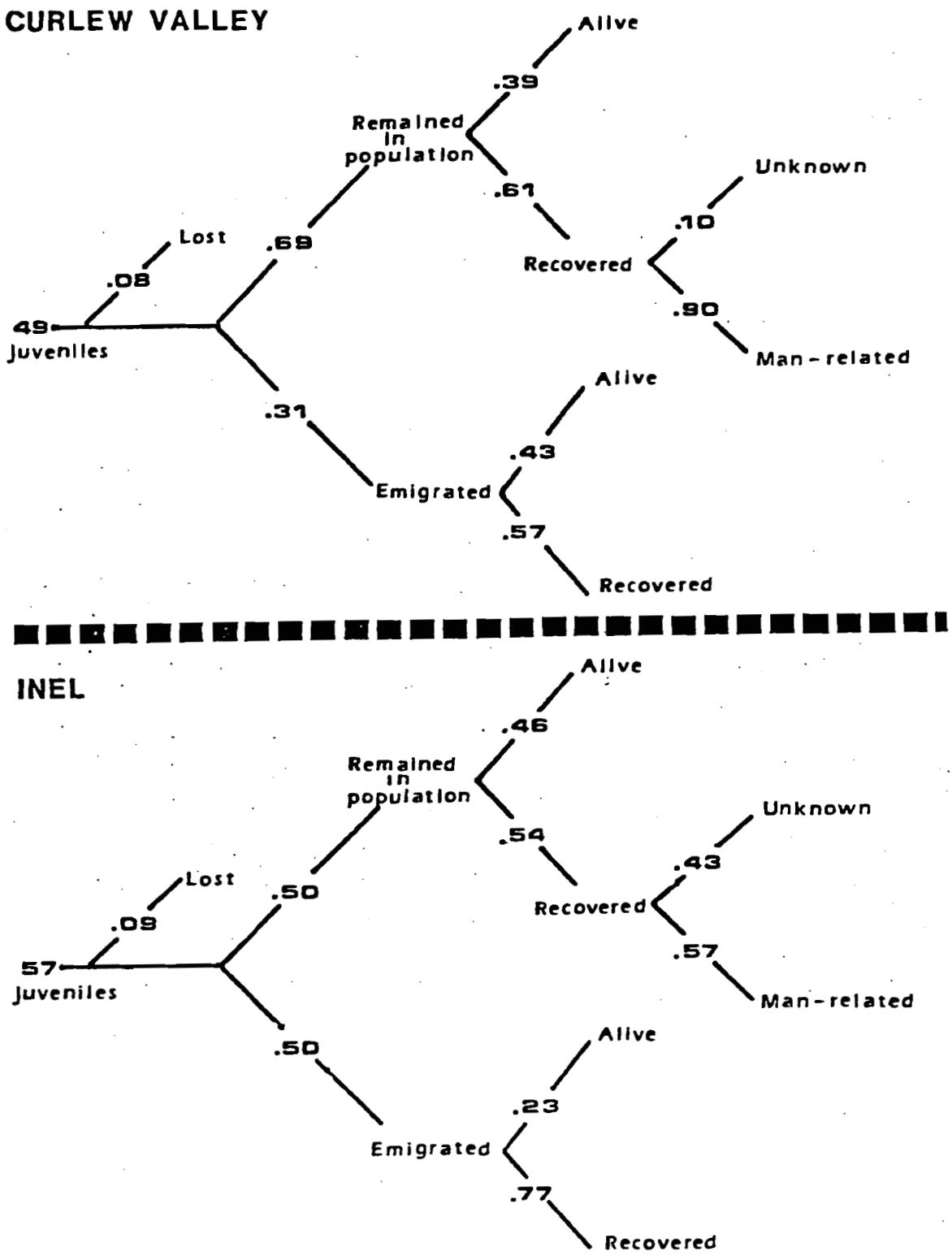

Figure 6. The fate of juvenile coyotes marked in Curlew Valley (1976-1977) and in the INEL (1975-1977) from release in September-October to June.

Table 14. Comparison of body weights at the time of first capture based on an individual's subsequent status during the period from release (September-October) to June.

	Status				
	Emigrated	Alive on study area	Died on study area	F ratio	Prob.
Curlew Valley					
Mean weight at capture (kg)	7.24 A	7.92 A	7.96 A	1.56	0.222
Sample size	14	12	19		
INEL					
Mean weight at capture (kg)	7.21 A	8.66 B	7.56 AB	3.98	0.025
Sample size	26	12	14		

[1]Means in a given row followed by a different letter are significantly different ($P < 0.01$).

cates that in a 'natural' coyote population, heavier, healthier animals remain residents while those that are lighter or in poorer physical condition are less likely to breed, more likely to emigrate and more likely to die.

5. IDAHO DATA: COYOTES CONTROLLED AND SHEEP LOST

Records have been kept, since 1928, in Idaho, on the number of reported sheep lost to coyotes as well as the number of coyotes killed in animal damage control activities (Table 15). In Figure 7a, sheep losses are plotted as a proportion of the total sheep in Idaho during each year. Figure 7b illustrates the total number of coyotes known to have been killed by ADC agents in each of these years. The data in Figure 7b also reflect changes in coyote population densities (Figure 5).

It must be recognized that the data in Figures 7a and 7b have been collected over a long period of time in which recording techniques, reported losses and control methods have varied. The figures for coyotes killed are lower than the actual number killed during the time toxicants were used. This is particularly true for the period 1949–1972 when 1080 bait stations were used. ADC agents report that coyotes killed by bait stations were rarely recovered due to the distance they traveled before dying. (They may travel as far as four miles before dying.)

From the mid-1930's to the mid-1940's many coyotes were killed. This was, at least in part, a result of the President's WPA program (Works Projects Administration). During the Depression, in Idaho, more than 100 unemployed men were hired to work as predator control agents.

The number of coyotes killed by ADC operations has declined steadily since 1973. ADC agents stress that the number of coyotes taken by private fur trappers plays a significant role in coyote control. Trapping data also show a general decline in the number of coyotes killed after 1973/74. The available pelt harvest data (Figure 8a) are subject to much variability. During those years for which data are available, harvest rate figures may not accurately represent Idaho coyote harvest as pelts are often transported to the state offering the best price. Fur prices (Figure 8b) undoubtedly also affect fur harvest rates.

Some trends are indicated by the sheep loss data. A peak loss period seems to occur approximately every ten years. No data are available for the 1950's, but aside from this, peak loss periods are 1944, 1966 and 1975. Interestingly, researchers studying jackrabbit cycles in Southcentral Idaho reported 1967 and 1975 to be the lowest years in the jackrabbit cycles (Figure 5). The dramatic climb in sheep losses from 1958–1966 also corresponds to a 1959–1967 fall in jackrabbit populations.

Table 15. Coyote control - sheep loss data for Idaho Animal Damage Control Program.

YEAR	SHEEP LOSSES			COYOTES KILLED	AERIAL KILL	1080 STATIONS	AERIAL HOURS	STRYCH-NINE
	CONFIR-MED	UNCON-FIRMED	TOTAL					
1928				1928				
1929				3399				
1930				3185				
1931				2568				
1932				3631				
1933				6747				
1934				9423				
1935				11120				
1936				8539				
1937	549	967	1516	17977				
1938	629	601	1230	15865				
1939	854	504	1358	14684				
1940	465	487	952	13057				
1941	665	954	1619	14387				
1942	655	976	1631	12170				
1943	997	1461	2458	8582				
1944	654	4281	4955	8926				
1945	533	1555	2088	9516				
1946	295	1468	1763	9115				
1947	191	1967	2178	8356				
1948	171	670	841	4327				
1949	94	299	393	3126				
1950	161	200	361	3711				
1951	77	199	276	2905				
1952				3106				
1953				2366				
1954				2654				
1955				2654				
1956				2005				
1957				2134				

YEAR	SHEEP LOSSES CONFIRMED	SHEEP LOSSES UNCONFIRMED	TOTAL	COYOTES KILLED	AERIAL KILL	1080 STATIONS	AERIAL HOURS	STRYCHNINE
1958			4377	3025	260	1566	301	6715
1959			4527	4262	309	1488	269	8010
1960			4748	5091	806	1391	401	8000
1961			7606	4694	440	1727	304	4000
1962			6653	4873	472	1685	418	5180
1963			5760	5210	403	1764	435	18710
1964			7227	5380	1073	1575	484	25538
1965			6431	4600	503	1646	395	39038
1966			7726	3037	389	1645	334	22100
1967				3033	498	1503	367	38750
1968			1784	2549	430	1453	364	9850
1969			1810	3239				
1970			1991	3233				
1971			1817	3911				
1972			1105	4409				
1973			1703	8744				
1974	1526	1564	3090	5492				
1975	1227	1862	3089	4515				
1976	955	1222	2177	5006				
1977	1053	1197	2250	3325				
1978	699	1312	2011	3551				
1979	877	1232	2109	2775				
1980	735	739	1474	2683				

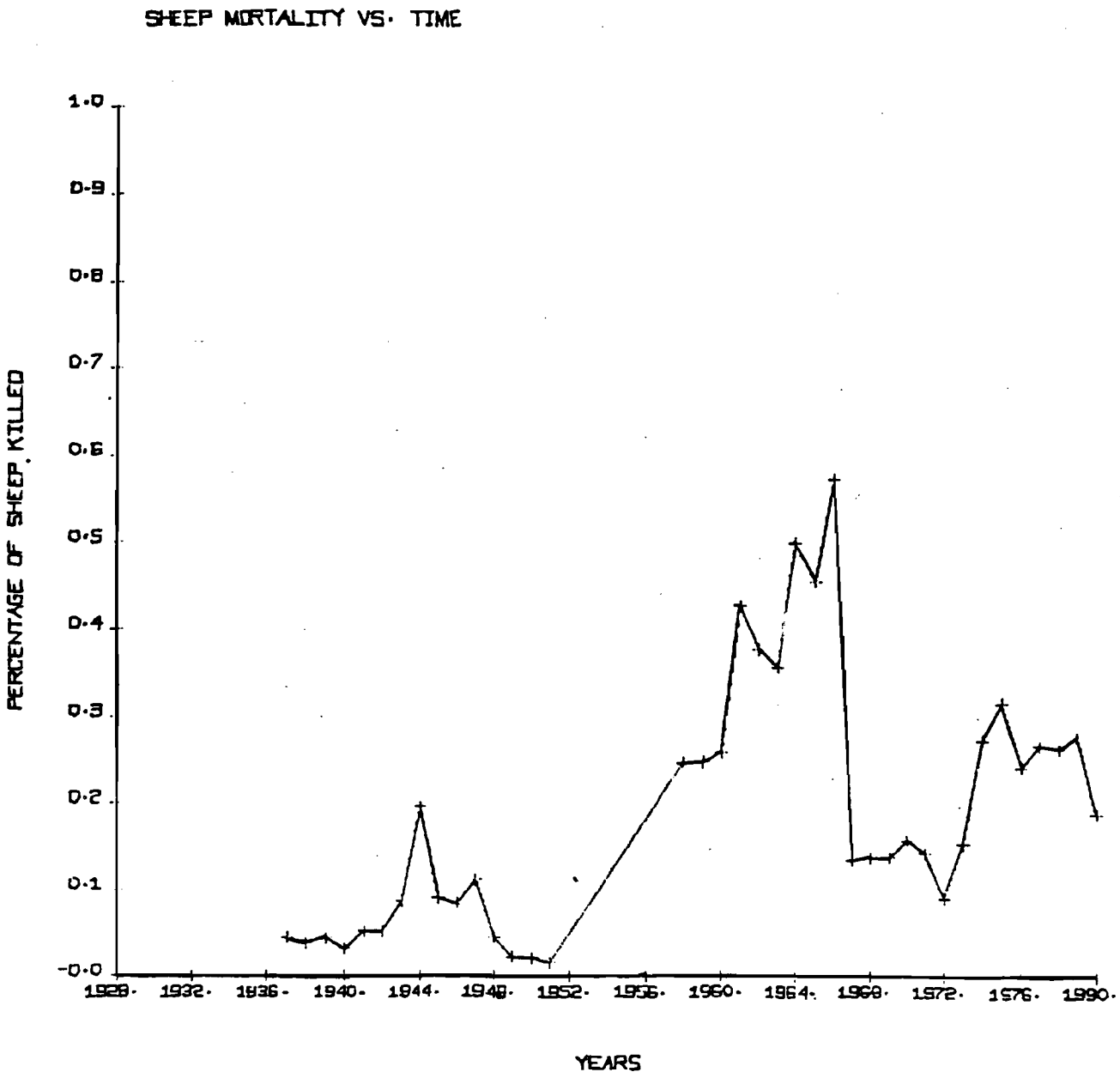

Figure 7. (a) Sheep lost (percentage of total sheep in Idaho, Figure 1). (b) Coyotes killed.

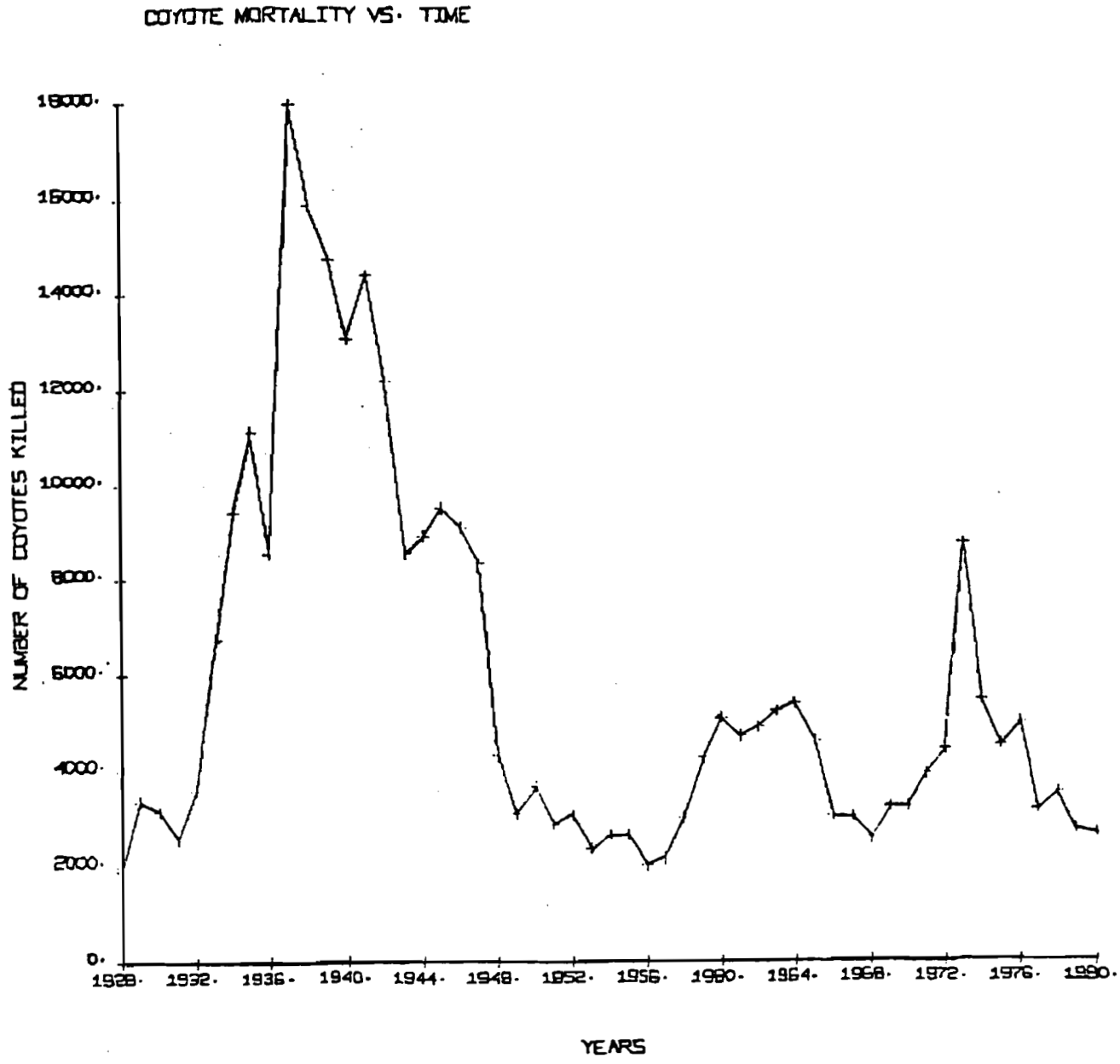

Figure 7. (b) Coyotes killed.

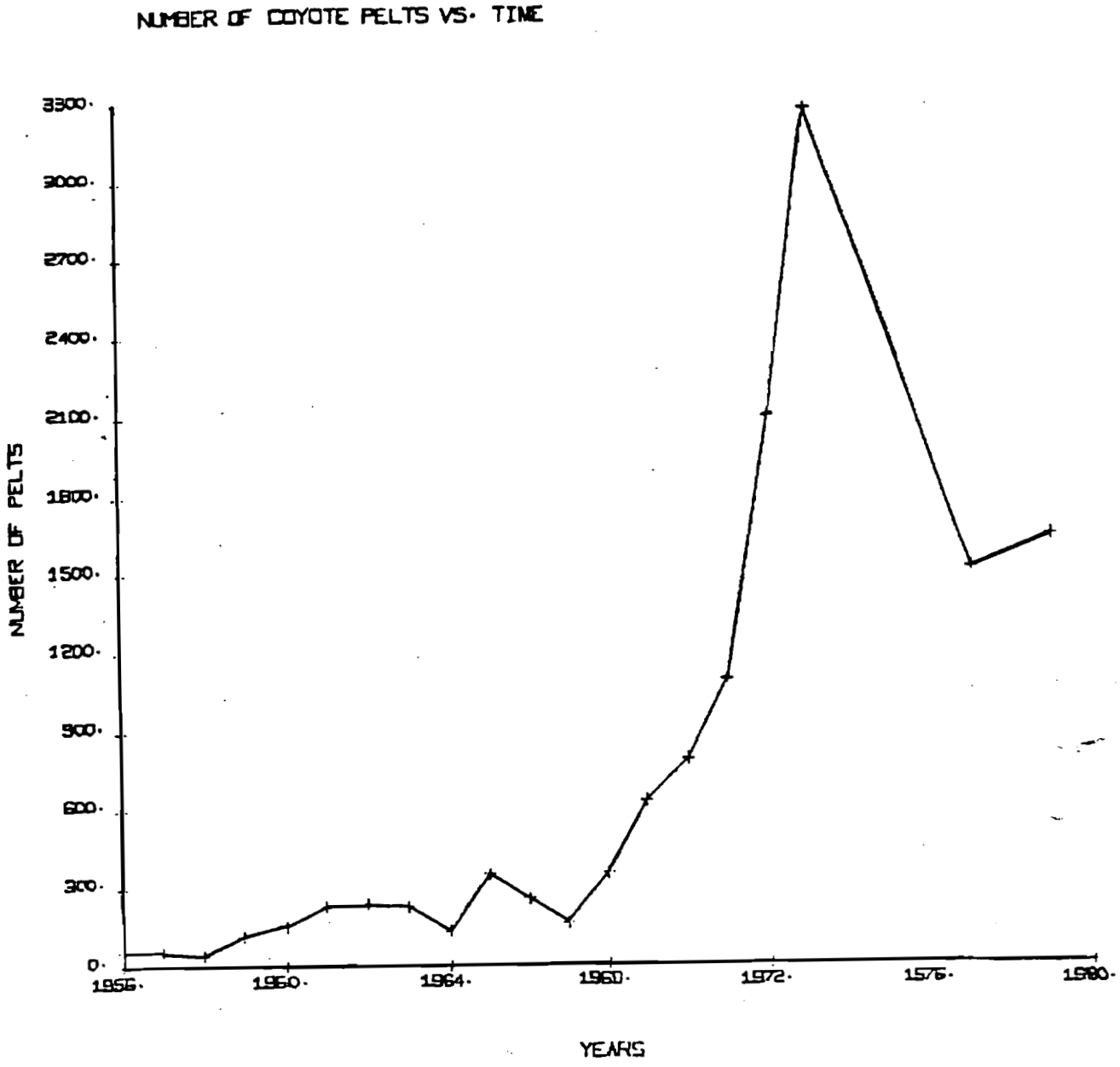

Figure 8. (a) Coyote pelt harvest. (b) Coyote pelt prices.

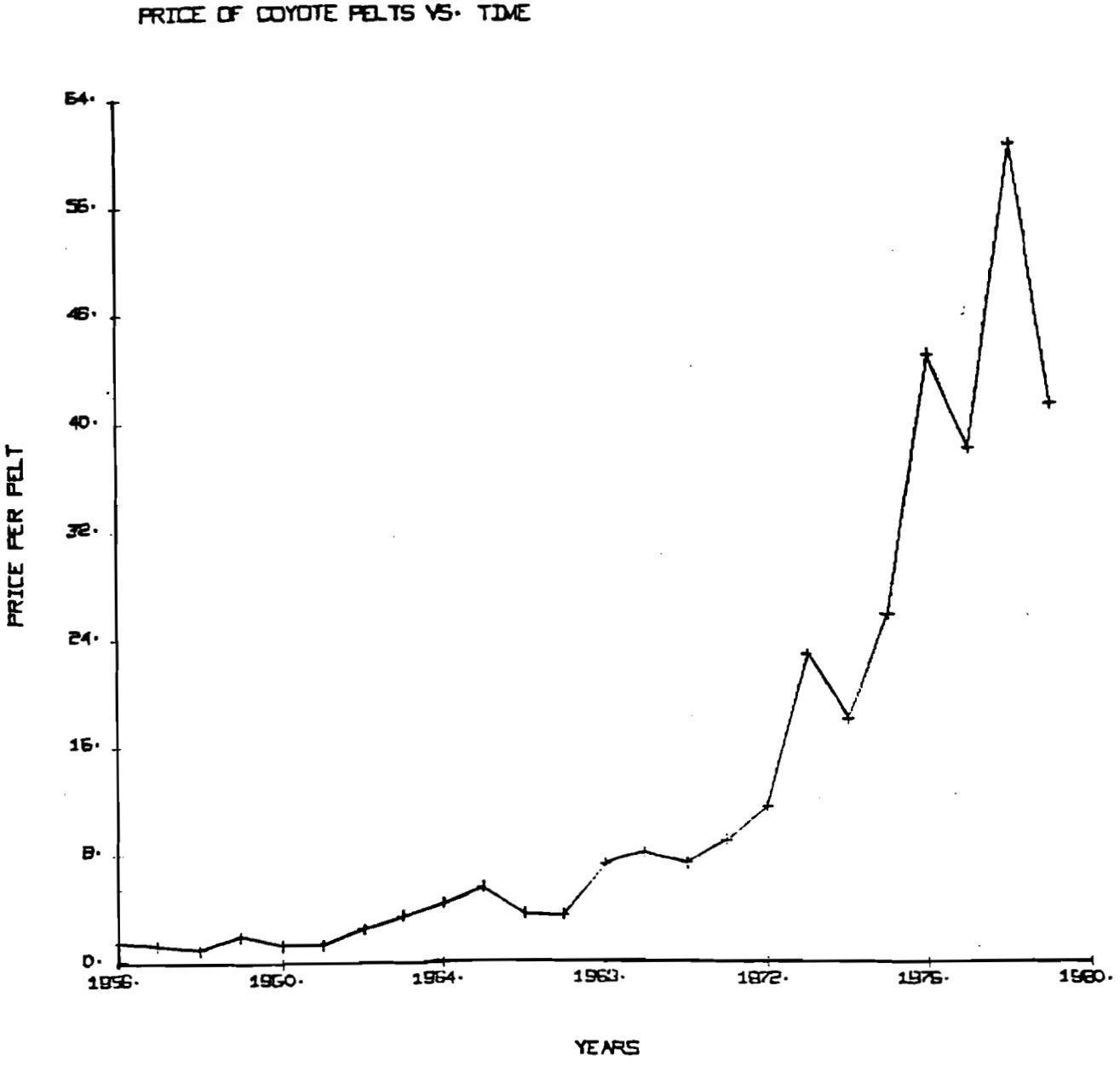

Figure 8. **(b) Coyote pelt prices.**

Keeping in mind the variety of techniques used to collect the data, it is interesting to note the substantial difference in the percentage of sheep lost in 1966 as compared with 1975. In 1966, when Compound 1080 was used, the percentage of sheep lost is 250 times higher than the percentage of sheep lost in 1975, three years after the toxicant was banned. During the period 1958–1966, when sheep losses climbed, the annual number of 1080 bait stations remained relatively constant ($\bar{X}$ = 1609), however the use of strychnine had increased by more than a factor of three (Table 5). During the nine year period prior to 1958, there was an annual average of 1782 bait stations.

ADC personnel believe that by 1966, 1080 bait stations had lost their effectiveness because coyotes had become 'bait-shy.' It is suggested that the coyotes had somehow learned to avoid the stations. Some agents believe that the animals learned to recognize the red stake required to mark the bait location. ADC, personnel also suggest that these stations became less effective because "the pattern was lost" in their placement. They suggest that by the late 1960's, fewer stations existed on account of land use restrictions. As a result, overall coverage had been decreased.

Subjective reports suggest that during the period prior to 1966, a greater proportion of the sheep were on the range. This greater proportion of range as opposed to farm flock operations might have contributed to the high loss rate in 1966 as compared to that in 1975.

Between 1966 and 1968 the percentage of sheep lost to coyotes declined dramatically (400%). ADC personnel recall many of the range operations instituting shed-lambing after 1966. This change may have been in response to the high losses that had been recently incurred.

Sheep losses rose in 1975, dropped in 1976, and then climbed from 1977–1979. In 1980, losses again declined. The information available on the degree of 1980 losses, however, is ambiguous. Loss data in Figure 7a are all from the resource loss charts in the year-end statements.

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APPENDIX I: 1931 ANIMAL DAMAGE CONTROL ACT

The Secretary of Agriculture is hereby authorized and directed to conduct such investigations, experiments, and tests as he may deem necessary in order to determine, demonstrate, and promulgate the best methods of eradication, suppression, or bringing under control of natural forests, and other areas of the public domain, as well as on State territory, or privately owned lands of mountain lions, wolves, coyotes, bobcats, prairie dogs, gophers, ground squirrels, jack rabbits, and other animals injurious to agriculture, horticulture, forestry, animal husbandry, wild game animals, fur-bearing animals, and birds, and for the protection of stock and other domestic animals through the suppression of rabies and tularemia in predatory or other wild animals; and to conduct campaigns for the destruction or control of such animals: provided that in carrying out the provisions of this Act the Secretary of Agriculture may cooperate with the States, individuals and public and private agencies, organizations and institutions.

(March 2, 1931, S.1, 46 Stat. 1468)

APPENDIX II: DIVISION OF WILDLIFE SERVICES POLICY, 1967

Definition

Animal damage control, as performed by the Bureau, is defined as the management of damaging bird and mammal populations at levels consistent with the needs and activities of man and includes environmental manipulation, reduction, the use of repellents and cultural methods. It is a cooperation venture, conducted or supervised as authorized and directed by Federal Law and carried out in compliance with applicable State and local laws or regulations. It excludes those species that are harvested or otherwise managed by State fish and game departments. However, upon request and in agreement with the State fish and game department, the Bureau may conduct control on problem individuals or relatively small groups of species that are under State management.

Objectives

The Bureau's animal damage control program will be designed in a manner which will ensure the maintenance of the varied native wildlife and wildlife habitats of the United States. In conducting this program, the Bureau must also be mindful of its responsibilities for protecting wildlife resources.

It is an objective of the Bureau to reduce animal depredation as selectively as possible, and to direct control at the depredating individual or local depredating population. Animal damage control will be conducted to achieve definite planned goals:

1. *Protection of human health and safety,* through animal control to reduce transmission of wildlife-borne diseases; and control of birds or other animal threatening human safety, such as birds in the vicinity of airports;
2. *Protection of urban areas,* where it is necessary to reduce and control hazards, damages, and economical losses in residential and industrial situations resulting from mice, rats, bats, and nuisance birds;
3. *Protection of forest, range and wildlife* where control is necessary to attain the management objectives of forest and range management, such as reforestation, range restoration, watersheds and wildlife management where social and economic benefits in these objectives are judged to offset the costs of animal control methods and the loss of the controlled species;
4. *Protection of crops and livestock* where control is necessary to reduce damage to growing and stored agricultural crops, and to protect livestock from depredation and wildlife-borne diseases, again where economic and social benefits are judged to offset all costs.

The animal damage control program will be conducted when and where there is a demonstrated need, as determined by the Bureau, after a careful review of all available evidence. It will be developed and supervised by professional personnel

who are aware of the ecological, social, and economic aspects of wild animal population manipulation. This program will be selective and humane to the extent possible and will utilize findings and advances in control technology.

Field testing of appropriate new animal control products and techniques selected from those produced by the Bureau and private industry will be accomplished in cooperation with other agencies and private industry.

The Bureau will maintain a continuing training and education program to reach all employees to make sure that they are current, not only current with the most recent concepts and technological developments in animal damage control work, but also with other aspects of resource ecology so that they can discharge their full responsibilities.

The annual work plan for animal control will be developed for each cooperating State. The work plans will be correlated with the plans of the Forest Service and the Bureau of Land Management so that they will be consistent with their multiple-use concept. The plans will also be correlated with the management objectives of other State and Federal agencies. They will also be related to the management objectives of the landowner, administrator, or lessee, where meeting these objectives is consistent with Bureau policy. The plans will set forth specific planned objectives. These plans will be carefully and promptly reviewed for adequacy within the Bureau. Annual reports and other periodic appraisals of program progress will relate to and report on the planned objectives set forth in the State plans.

The Bureau will maintain firm supervision over the conduct of its animal control at all levels of supervisory authority and will enforce strict adherence to the policy, regulations, and rules set forth. Field inspections will be conducted to assure compliance.

Cooperation

Operational animal damage control will be conducted in accordance with cooperative agreements between the Bureau and other agencies, organizations, and individuals requesting assistance in those States where a master cooperative agreement has been executed. Ideally, a master agreement with the State should involve the State fish and game department, the State health department, the State department of agriculture, and the State extension service. Maximum flexibility in use of personnel, appropriate control methods and maximum responsibility for program conduct will be sought when agreements are negotiated. The Bureau will consult with and inform cooperators on a continuing basis.

Determining the need for animal damage control is not the sole responsibility of the Bureau. Increased reliance will be placed on the land and resource managing agencies; on public health organizations; on industry and agriculture; on State fish and game departments; other cooperating agencies and organizations; and on their responsible officials and elected representatives, to contribute to the determination of when and where there is a demonstrated need for control within their areas of jurisdiction or concern. The final determination, however, as to its participation in a requested control project will rest with the Bureau. Decisions relating to animal damage control may be appealed through appropriate agency channels.

The Bureau will encourage an interchange of information between private and commercial pest control operators and this Bureau to assist the operators in their efforts to maintain and improve professional competency. The Bureau will avoid direct competition with the commercial operators in situations where they can pro-

vide comparable and competent services, and where wildlife values are likely to be adequately protected by these operators.

The Bureau animal damage control personnel will not solicit the initiation or expansion of control programs. These personnel will, however, report program progress to cooperators and will be available on request to discuss, interpret, and demonstrate practices and techniques.

Operations

Animal damage control may be conducted by the Bureau on a direct, operational basis or by using education or extension techniques. The operational services of the Bureau will be available only where needed and only upon the request and with full approval of the landowner or operator, duly constituted officials, or responsible land or resource managing agencies. Direct operational control may be conducted under those circumstances where techniques require professional skill.

A written justification must be prepared whenever it is necessary to remove a bear or lion damaging or about to do damage to livestock or natural resources. In emergencies, such justification may be submitted immediately following removal. These species are generally game animals, under the protection of State game laws. Moreover, they are particularly prized parts of the Nation's wildlife heritage. Consequently, there must be a documented reason, based on damage or actual threat, for taking them. This will be accomplished in particularly close operation with the State fish and game departments.

The educational or extension approach will be encouraged whenever possible. The Bureau will provide information and recommendations to safe, selective, and efficient animal damage control techniques to requesting individuals or organizations.

Animal damage control may also be conducted in cooperation with commercial pest control firms, the Federal Extension Service, State health departments, or other governmental agencies. The Bureau does not approve of the bounty system and will not engage in it or encourage its use.

When toxicants and control devices are required, they will be used in such a manner as to minimize hazards to non-target species. Only Federally registered chemicals will be utilized in control programs, and only by the methods of application approved by the Federal Committee on Pest Control. Warning signs will be used when control techniques might present a hazard.

Animal damage control programs will not be conducted within or adjacent to the ranges of endangered wildlife species without the specific written approval of the Director of the Bureau. All applicable precautions, such a pre-control surveys will be exercised to minimize hazards to endangered species. Alternate methods of control will be employed if the most effective control method for the target species presents a hazard to the endangered species. If this still does not offer adequate protection to endangered species, control work will not be undertaken.

The Bureau will use "multiple forces" teams, comprised of highly skilled animal damage control personnel to utilize fully its supervisory and manpower capabilities to the maximum benefit of the program. These teams, consisting of men regularly assigned elsewhere, will be available to work intensively in any area of the Nation in response to emergency or critical situations.

Technical assistance in bird control will be provided by the Bureau where there is demonstrated need and when effective methods are available. The Bureau will provide bird control information, technical advice, and assistance on request to the extent of its capabilities. Commercial pest control organizations will be encouraged to conduct needed bird control operations where such control is needed and justified in the judgment of the Bureau.

Research

The Bureau will maintain a strong and continuing research effort to find new, improved, selective and human control methods. It will conduct studies in animal ecology and life history biology, seeking alternate methods of control. Research findings will be made available periodically, and close coordination will be maintained with management and control personnel, and with private industry.

Details for implementation of this policy will be contained in a revised field manual and in subsequent policy directives as appropriate.

APPENDIX III: ANIMAL CONTROL POLICY - ANIMAL DAMAGE CONTROL (ADC)

President Carter's Environmental and Energy Message to Congress, in the Wildlife Section, stressed that predators play a very important role in various ecosystems and our goal should be not to destroy them but to reduce the occasion for their conflict with livestock. If control is necessary, it should focus on the individual predators causing the problem - not the species as a whole.

Our current animal control policy is well within the goal established by President Carter. However, all ADC Personnel and cooperative ADC Employees should be reminded that our policy objective is "... To reduce predation as selectively as possible, and to direct control at the depredating individual or a local depredating population." However, preventative control may be utilized in those areas with a history of predation in order to reduce the occasion for conflicts with livestock.

From: Associate Director - Fish and Wildlife Resources, July 21, 1977

APPENDIX IV: PROGRAM GUIDANCE

The policy statements for the Animal Damage Control Program provide guidance for how Program objectives will be achieved. Some statements express the Service's position on an issue of particular concern. It is intended that policy will be added, deleted or modified as conditions dictate.

General Policies

1. In the near term, preventative control of predators should be limited to specific situations where unacceptably high levels of losses have been documented during the preceding 12 months. In the long term, through additional research, the use of lethal preventative controls, including creation of buffer zones, should be minimized and phased out.
2. The Program will emphasize corrective control, utilizing non-lethal/non-capture methods and focus on offending animals to the greatest degrees possible.
3. The Program will reduce conflicts between predators and livestock by encouraging the use of appropriate livestock husbandry techniques which decrease exposure of livestock to predators.
4. The Program will expand the availability of extension services to ranchers.
5. The practice of denning should be eliminated and the use of aerial shooting, particularly in winer, should be tightly controlled.
6. All efforts will be made to utilize traps in the most selective and human manner possible, through such practices as the use of tension devices, prohibition of bait sets, and frequent checks of traps.
7. Any research on Compound 1080 development or uses must be approved by the Secretary.
8. The Program will emphasize the development and testing of non-lethal/non-capture control methods (such as scare devices, aversive agents and fencing) and intensive husbandry techniques and practices. Testing will be done under a variety of seasonal, geographic and ranching conditions so that practical conclusions may be drawn for field applications.
9. Although some research, especially in the husbandry practice area, may be financed wholly or in part by USDA. Or others, the Program should be prepared to undertake a research effort on these techniques if necessary.
10. In recognition of Presidential policy concerning use of toxicants, the Program will continue research on toxicants displaying species specific characteristics and delivery systems with use patterns that are selective for target individuals.
11. Predator damage control on public lands will be conducted in accordance with interagency working group recommendations approved by the Assistant Secretary, Land and Water, Assistant Secretary, Policy, Budget and Administration, and Assistant Secretary, Fish and Wildlife and Parks. The interagency work will be composed of representatives of FWS, BLM and USFS.

12. All Service animal damage control research and study activities will be coordinated for the ADC Program by the Washington office of Wildlife Research.
13. A Research Advisory Committee will oversee the performance and application of predator damage control research efforts and assure that all new ideas are given fair attention. This Committee should include representatives of the livestock industry, the environmental community, academia, CEQ, EPA, BLM, the Forest Service and a representative of the Office of the Secretary.
14. Non-Service funded animal damage control research will be conducted when it is compatible with Service needs and priorities.
15. The Service will encourage universities, State governments, manufacturers of damage control tools, groups adversely affected by wildlife, and others to support animal damage control research.